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Infinite riches in a little room

—CHRISTOPHER MARLOWE

New Americanized

ENCYCLOPÆDIA BRITANNICA

(Twentieth Century Edition)

A DICTIONARY OF

ARTS, SCIENCES, AND LITERATURE
with Many Articles by Special Writers

FULLY ILLUSTRATED

and Revised throughout to Date, with over
ONE HUNDRED COLORED MAPS



IN TEN VOLUMES

VOL. I—A—AUDUBON

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REMOTE STORAGE

PREFACE.

The compilation of an encyclopædia may be fairly regarded as one of those "inventions" that are said to be born of necessity. The march of science, the growth of literature, the development of art, combine to demand an encyclopædia. With the increase of stores comes the need of the storehouse, with the larger wealth of grain comes the necessity of a commodious granary. And this is precisely what an encyclopædia is—a storehouse of knowledge, a granary of the treasures of truth. The word encyclopædia has a very wide significance. We are greatly indebted to the dead languages of long ago for many of our best names and clearest definitions. This word, for example, is composed of two Greek words, κύκλος, a circle, and παιδεία, instruction or knowledge. In the combination of these two words we get this comprehensive word encyclopædia, which means, the circle of knowledge, the complete round of the arts, the sciences, and all literature.

Many centuries ago—long before the invention of the printing press—great students felt the need of something like an encyclopædia. Seneca complains of the "distraction" that comes of a multitude of books; and, in effect, suggests that every man should make his own encyclopædia. "What is the use," he asks, "of countless books and libraries whose owner hardly reads through their titles in his whole life? . . . We ought to imitate the bees, and to separate all the materials which we have gathered from multifarious reading, for they keep best separate; and then by applying the study and ability of our own minds, to concoct all those various contributions into one flavor." These words were spoken before the dawn of the Christian era, when reading was a luxury rather than a habit, and books were among the costliest treasures men possessed. How much more impressively would Seneca speak if he could witness the floodtides of literature that in our age are pouring forth their treasures night and day without ceasing.

There are two forces at work in these days that tend to make a good encyclopædia an indispensable possession. The first of these is the vast number of books published, rendering it quite impossible for the most industrious student to keep abreast of the literature of his time; and the next is the busy, restless character of

the age, that absorbs so largely the energies of men in the acquirement of material wealth, that they have but little time, and by reason of the weariness that comes of overwork, but little inclination for literary pursuits. In this connection the wonderful growth of literature in the past few years is well worth a moment's consideration. In the full blaze of the noontide we are apt to forget the grayness of the dawn; and in the prodigal richness of our literary possessions we are apt to forget that it is not so very long since libraries were the luxuries of the rich, and the books of the poor were few. It is within the remembrance of men now living, when a dozen books would comprise the library of ordinary homes, but now the households are few where there is not a moderate representation, at least, of general literature. There is an embarrassment of poverty, and there is an embarrassment of riches, and which of the two is most embarrassing it is not quite easy to tell. In the matter of literature we are suffering most from the embarrassment of riches. It is a pleasant thing to ramble along the banks of a river, but to stand upon the shore of an illimitable sea inspires awe rather than gladness. And this is exactly our case in the matter of books. They overflow all our banks of opportunity, they inundate us with their wealth. In support of this conclusion a few figures relative to the great mass of books issued annually by the press of Europe and America may be at once interesting and suggestive.

Literature has three distinct departments; the technical, the general, and the ephemeral. Under the head of the technical, all works of reference are included, such as encyclopædias, dictionaries, lexicons, text-books, manuals, and the like. These are for the university, the college, the high school, and the study. The increase in this department is not, of course, very large, and yet the annual growth of even technical literature is much greater than we commonly suppose. These books are for study and consultation rather than for reading. Under the head of general literature, the whole realm of books which people read, rather than study, must be classed. Poetry, history, fiction, travel, biography, essays, and criticism all come under this head. It is with this department of literature we are now dealing. The ephemeral, which includes newspapers, magazines, reviews, and the like, has perhaps hardly a just claim to be regarded as literature. The enormous quantity of this class of work poured forth every day from the press, utterly defies all attempt at tabulation. Concerning the output of general literature it is possible to arrive at some approximate understanding. The number of new separate books published in Europe and America annually, has been steadily on the increase for the last twenty-five years, until now the press of Europe and America issues more than 20,000 new works of general literature every year. The man who boasts that he will keep abreast of current literature, is confronted with the Herculean task of dealing annually with 20,000 books, to say nothing of the claims of books of reference and ephemeral literature, which cannot be wholly set aside.

Now, what are the possibilities for the most studious and industrious of men?

If we take these volumes as averaging the size of an ordinary book of about three hundred pages, we shall be under rather than over the mark. The ordinary reader will not read more than one such book a day, even if he should devote the major portion of his time to the task. Now, let us give our diligent student his Sundays free from reading, with a few days for holidays, and, at most, we find he is able to get through three hundred volumes a year. No one will deny that the reading of three hundred books a year represents good, hard, honest work, even if the reader has little else to engross his attention. But the march of literature is too much for him. He begins the race on the New Year's morning bravely; he toils faithfully on through spring and summer, through seed-time and harvest, but when the end of the year comes, he is nineteen thousand seven hundred books behind, and the dawn of the new year brings him twenty thousand more! Let us suppose this course of diligent reading to be pursued for the larger working portion of a long life, say for fifty years. What then? Our untiring student has read fifteen thousand books! But literature—even if her pace has remained the same—has beaten the student by nine hundred and eighty-five thousand volumes!

There is no logic so stern and unbending as the logic of facts. And this set of facts may well make a thoughtful man pause and wonder. What shall we do? Because of the impossibility of dealing with this great mass of literature, shall we give up in despair? Shall we refuse a well-chosen bouquet because we cannot have all the flowers of the garden? Shall we decline to gaze upon the patient, peaceful stars, because we can only see a few thousands, while uncounted millions lie beyond the range of our vision? True wisdom suggests that we use the winnowing fan with unsparing hand; that we let the chaff fly on the wings of the wind, while we garner the finest of the wheat with jealous care. But after all our winnowing, and care, and prudence, there must remain an enormous mass with which we cannot deal. And it is just here where a comprehensive and reliable encyclopædia comes, if not to solve the whole problem at issue, at least to render efficient and invaluable aid in circumstances environed with perplexities.

The *Encyclopædia Britannica*—of the latest and ninth edition, of which this is a condensed, amended, and an Americanized edition, prepared at infinite cost and labor for American people—is without controversion the grandest monument of scholarly research and patient endeavor in the whole realm of literature. It was commenced in 1771, and was then composed of three volumes, and was little more than a dictionary of arts and sciences. The first edition of the encyclopædia proper was issued in 1776, when historical and biographical subjects were added, increasing the stately compilation from three to ten volumes. In 1797 the third edition of eighteen volumes was issued. In 1810 the fourth edition appeared, composed of twenty volumes. The latest and ninth edition, of twenty-four

volumes, was issued about fifteen years ago. It is this latest and most perfect edition of this unparalleled work, born of the culture and genius of the best minds of a century, that is here presented, having undergone the most thorough and exhaustive revision and amendment, making it preëminently suitable for the American people. The AMERICANIZED ENCYCLOPÆDIA BRITANNICA contains all that is important to know, in a nutshell—compact, reliable and intelligible. Here is an entire library of knowledge; the realization of Christopher Marlowe's ideal definition of a book: "Infinite riches in a little room."

There are certain special points of interest in this invaluable work to which it is desirable to call particular attention:

1. In respect of the process of condensation. While there has been the utmost care in the matter of condensation, there has been no elimination of subjects. Not one subject has been left out. It is obvious, however, that many of the themes discussed have a relative rather than universal interest. There are many matters of interest to Europeans that cannot, in the nature of the case, have the same interest for Americans. Many of the details of historic events that are probably of great importance in a work distinctively Britannic, are not of equal importance in a work distinctively American. For example, the English reader will be interested in all the details of the Battle of Waterloo, while the American reader will be more concerned about the details of the Battle of Gettysburg, the decisive battle of the War of the Rebellion. The work of condensation and the work of amendment, have been wrought with equal care, in order that nothing of Old World interest might be omitted, and that due reference might be made to those grand personages and events which have made the history of America the wonder and admiration of the world.

One or two examples of the method of condensation will best indicate how judiciously the work has been done. The examples are taken at random. The first is the case of HERTFORDSHIRE. The County of Hértford, in the south of England, is rich in romantic history that antedates the Christian era, all of which is of great interest to the antiquarian. There are also matters of geography, geology, population, products, political characteristics, etc., which are dealt with in detail in the following article; but these details, interesting as they may be to English readers, cannot be equally interesting to Americans, and yet it will be observed that in the condensed article on the opposite column, everything of importance has been retained, and no salient point that could interest the general reader has been eliminated. The second example is of an American city—MONTGOMERY, the capital of Alabama. In this case the order has been reversed. The details that are of deepest interest to every American, not to be found in the original edition, are fully supplied in the AMERICANIZED ENCYCLOPÆDIA BRITANNICA.

HERTFORD, COUNTY OF, HERTFORDSHIRE, or HERTS, an inland county in the southeast of England, is situated between $51^{\circ} 36'$ and $52^{\circ} 5'$ N. latitude and $0^{\circ} 13'$ E. and $0^{\circ} 45'$ W. longitude. It is bounded on the north by Cambridgeshire, northwest by Bedfordshire, east by Essex, south by Middlesex, and southwest by Buckinghamshire. The area comprises 391,141 acres or 632 square miles.

The aspect of the county is pleasant and picturesque, its surface being broken by gentle undulations which in some parts form a quick succession of hills and valleys. The highest summit is Kensworth Hill on the border of Bedfordshire, about 910 feet above sea-level. Fine oak and other trees are grown in the hedges, and from being pruned obliquely they form high walls of living timber shading narrow winding lanes. The arable and pasture lands of the farms are intermingled with the parks and ornamental woods of the country seats which are scattered thickly throughout the county. These features varied by its winding rivers, impart to it a peculiar beauty, while in luxuriance it is not surpassed by any county in England.

The principal rivers are the Lea, which, rising some miles beyond Luton in Bedfordshire and entering Hertfordshire at Hidemill, flows southeast to Hatfield and then east by north to Hertford and Ware, whence it bends southward, and passing along the eastern boundary of the county falls into the Thames a little below London, having received in its course the Maram, the Beane, the Rib, and the Stort, which all flow southward in the northeastern part of the county, the Stort for some distance forming the boundary between it and Essex; the Colne, which, flowing through the southwestern part of the county, falls into the Thames at Brentford, having received in its course the Ver, the Bulborne, and the Gade; the Ivel, which, rising in the northwest of the county, soon passes into Bedfordshire. The New river, one of the water supplies of London, made by Sir Hugh Myddleton (1607-13), has its source in some springs near Ware, and runs parallel for many miles with the Lea. The Grand Junction canal from London to Birmingham traverses the southwest corner of the county, passing by Watford and Berkhamstead. There are mineral springs in the parishes of Chipping Barnet, Northaw, and Watton.

Geologically the county consists of Cretaceous and Tertiary rocks, the greater part being Lower, Middle, and Upper Chalk, which in the southeastern part of the county are covered by Tertiary deposits belonging to the London basin. Over a large part of the eastern side of the county there are superficial deposits of glacial origin, and on the western side there are traces of the Lower Tertiary beds having formerly extended over a much wider area, outliers of the beds being of not infrequent occurrence, and the drift deposits on the chalk hills being largely composed of their debris. The vales traversed by the rivers and streams exhibit in the bottoms a rich sandy loam; the sloping sides are covered by loams of inferior quality; and the flat surface of the high ground is generally formed of a loam of reddish hue tending toward common clay, with which it is often confounded.

The climate is mild, dry, and remarkably salubrious. On this account the London physicians were accustomed to recommend the county for persons in weak health, and it was so much coveted by the noble and wealthy as a place of residence, that it was a common saying: "He who buys a home in Hertfordshire pays two years' purchase for the air."

According to the agricultural returns for 1870, the total area of arable land was 339,187 acres, of which 145,666 acres were under corn crops, 39,443 under green crops, 38,416 under rotation grasses,

HERTFORD, or Herts, an inland county of England, lying north of Middlesex, south of Cambridgeshire and Bedfordshire, and west of Essex. Its area is 391,141 acres, all highly cultivated land, the county being about equally divided between pasture and arable farms. It is watered by numerous small streams, from three of which, the Lea, the Colne, and the new river (the latter an artificial conduit), part of the London water supply is obtained. The subdued beauty of the landscape and its contiguity to London have rendered this county for many years a favorite residential district, and it contains hundreds of country-seats of the nobility. It is well-wooded and produces the best wheat in England. Much of the land is used as market gardens, and orchards are plentiful.

Farms average about 200 acres in extent, and cultivation is carried on with all modern improvements. Hertfordshire is traversed by four great trunk lines of railroad; the Great Eastern, the Great Northern, Midland, and London and North-Western. The old Roman roads to York, to St. Alban's and Bedford and to Warwick, cross it, and its highways are among the best in the kingdom. The Grand Junction canal passes through its southwestern border and furnishes with its feeder, the Colne river, water-power for hundreds of flour-mills. Hertfordshire contains numerous breweries, tanneries, tile works, and carriage factories. Its principal manufactures are, however, silk, paper and straw plait.

The county town is Hertford, population 8,000. Other towns, ranging from 9,000 to 4,000, are St. Albans, Hitchin, Watford, Bishop Stortford, Hemel-Hempstead, Ware, Berkhamstead, Tring, and Barnet. The county returns three members to parliament, and the borough of Hertford sends one. The population, in 1901, was 258,045.

Hertfordshire is one of the most interesting counties in England to the antiquary. Verulamium (now St. Albans) was the capital of the Cassii, whose chief Cassivelaunus was defeated by Cæsar 54 B.C., and numerous Roman earthworks are still visible. St. Alban, the proto-martyr of Britain, suffered death at the city named after him, and the abbey, still in magnificent preservation, was founded in 793 A.D. During the Wars of the Roses two great battles were fought at St. Albans, and at Barnet the Earl of Warwick was defeated by Edward IV. Francis, Lord Bacon, lived at Gorhambury; Queen Elizabeth at Hatfield House, the present seat of the Marquis of Salisbury; William Cowper at Berkhamstead, and Lord Lytton at Knebworth.

97,538 permanent pasture, and 18,111 fallow. The area under woods was 20,714 acres. It will thus be seen that the main produce of Hertfordshire is corn. The principal crop is wheat, which, in 1879, occupied 59,363 acres. The varieties mostly grown are white, and they are not surpassed by those of any county in England. Wheathampstead on the river Lea receives its name from the fine quality of the wheat grown in that district. Of barley, which is largely made use of in the county for malting purposes, there were 49,129 acres in 1879, and of oats only 25,779. Little or no rye is grown, and of pease and beans together there were in 1879, only a little over 11,000 acres. Of green crops, turnips and swedes occupied in 1879 an area of 21,578 acres, while potatoes had only 2,576. Vetches are largely grown for the London stables, extending to 8,191 acres in 1879. The greater part of the permanent grass is made use of for hay. There are some very rich pastures on the banks of the river Stort, extending from Hertford to Hockeril on the borders of the river Lea, and also near Rickmansworth, where they are watered by the river Colne. The percentage of cultivated area in 1879 was 80.7 instead of 85.1 in 1870. Of area under corn crops 37.2 instead of 38.5; under green crops 10.1 instead of 11.5; under rotation grasses 9.8 instead of 10.2; and of permanent pasture 24.9 instead of 22.0. The most common system of rotation is the five-course — turnips or fallow, barley, clover, wheat, oats. In the southwest part of the county large quantities of cherries and apples are grown for the London market. On the best soils nearest to London culinary vegetables are forced by the aid of rich manure, and more than one crop are sometimes obtained in a year.

Generally speaking, the quantity of stock kept is small. Not much attention is paid to the breeds of cattle, but among cows the Suffolk variety is the most common. The number of cattle in 1879 was only 31,754, or an average of 9.3 to every 100 acres under cultivation, the average for England being 11.9, and for the United Kingdom 21.0. Of these the number of cows in milk or in calf was 11,802. The number of horses in 1879 was 15,022, or an average of 4.4 to every 100 acres, the average for England being 4.5 and for the United Kingdom 4.1. The horses used for agricultural purposes are chiefly Suffolk punches. The number of sheep in 1879 was 171,133, or an average of 50.4 to every 100 acres under cultivation, the average for England being 75.3, and for the United Kingdom 68.0. The principal kinds are the Southdowns and Wiltshire, and a cross between Cotswolds and Leicesters. Pigs in 1879 numbered 30,404, or an average of 8.9 to every 100 acres under cultivation, the average for England being 7.2, and that for the United Kingdom 6.7.

In Hertfordshire the number of resident proprietors is very large, which circumstance, as well as the proximity to London, has doubtless greatly aided the development of agricultural enterprise. The average extent of the farms is about 200 acres, and the modern improvements are everywhere adopted.

According to the return of owners of land for 1872-73, the soil was divided among 12,387 proprietors, holding land the gross annual rental of which was £1,033,192. Of the owners 77 per cent. held less than one acre, and the total annual value for the county was £2 17s. 3¼d. per acre. There were only eight proprietors who held upward of 4,000 acres, viz., Marquis of Salisbury, Hatfield, 13,389; Abel Smith, Watton, 10,212; Earl Cowper, Panshanger, 10,122; Earl of Verulam, Gorbamby, St. Albans, 8,625; Earl Brownlow, Ashridge Park, 8,551; Lord Dacre, The Hoo, Welwyn, 7,100; Charles C. Hale, King's Walden, 6,558; and Earl of Essex, Cashibury Park, Watford, 5,157. W. R. Baker, Bayfordbury, comes next with 3,911 acres.

The staple trade of the county is in corn and malt, most of which is sent to the metropolis. There are numerous flour-mills, as well as breweries, tanneries, tile-works and coach factories, but the principal manufactures are paper, silk and straw plait.

Hertfordshire is so much intersected by railways that no place in any part of the county is more than five miles distant from a station. On the eastern border there is the Great Eastern, with branches to Hertford and Buntingford. The middle of the county is traversed by the Great Northern, with branches from Hatfield to Hertford, Luton, Dunstable and St. Albans, and from Hitchin to Royston, and thence to Cambridge. The Midland passes through St. Albans, with branches to the Great Northern and London and North-Western. The London and North-Western traverses the southwestern corner.

The county comprises eight hundreds, and the municipal boroughs of Hertford and St. Albans. The principal towns are the municipal and parliamentary borough of Hertford (municipal borough, 7,169), the city of St. Albans (8,298), Hitchin (7,630), Watford (7,461), Bishop Stortford (6,250), Hemel-Hempstead (5,996), Ware (4,917), Berkhamstead (4,083), Tring (4,045), Barnet (3,720). For parliamentary representation the county is an undivided constituency, and returns three members, while one member is returned for the borough of Hertford. Hertfordshire is in the southeastern circuit. There were formerly two courts of quarter sessions, one for the county and one for the liberty of St. Albans, which liberty had also a separate commission of the peace, but the county and the liberty are now amalgamated, though prisoners are tried both at Hertford and St. Albans. The jail for the county is at the latter city. The county is divided

into fifteen petty sessional divisions, and for some purposes into two divisions, those of Hertford and the liberty of St. Albans. The boroughs of Hertford and St. Albans have commissions of the peace. Ecclesiastically the county is in the diocese of St. Albans, and contains 138 civil parishes, townships or places, as well as parts of other parishes extending into adjoining counties. The total population in 1871 was 192,226, of whom 93,244 were males and 98,982 females. The population in 1861 was 173,280. Since the first census in 1801 it has increased by 94,833, or 97 per cent.

History and Antiquities.—Previous to the Roman invasion the Celtic inhabitants of Hertfordshire, as of the other parts of South Britain, had been subdued by the Belgæ. In 54 B.C. Cassivelaunus, the chief the Cassii, led an army to oppose Cæsar, but he was defeated, and his capital Verulam, near the present town of St. Albans, taken. At Verulam and Berkhamstead traces of ancient British works may yet be seen; and it has been conjectured that British stations existed at Royston, Braughing, and various other places in the county. Numerous British coins have been found at Verulam. Three principal British roads or trackways crossed the county: Watling Street passed through its southwest corner in a northwest direction by St. Albans to Dunstable; Ermine Street entered the southeast corner at Little Hookgate, whence it proceeded by Gough's Oak and Broxbourne Bury to Ware, holding thence much the same course as the present road by Buntingford to Royston; Icknield Street, from Dunstable to Royston, crossed the northwest corner. There are numerous barrows at Royston, and along the range of chalk hills at the northern edge of the county. Hertfordshire was the scene of an important part of the struggle carried on against the Romans by Caractacus about 44 A.D.; and during the rebellion of Boadicea the Romans were defeated on the road from Verulam to Colchester, and Verulam itself was taken and devastated by the Britons. The shire was included within the Roman province of Flavia. Among the Roman stations within its limits were the capital *Verulamium*, which the Romans rebuilt and fortified; *Forum Diana*, not far from Dunstable; *Ad Fines*, supposed to have been near Braughing, where there are remains of a vallum with fosse; and probably others at Royston and Bishop Stortford. Watling Street and Ermine Street were causewayed as Roman roads, and other branch roads traversed the county in various directions. Roman antiquities have been found at Verulam, Braughing, Royston, Wilbury Hill (where there are remains of an ancient camp), Cheshunt, Hemel-Hempstead, and Bishop Stortford. After the conquest of England by the Anglo-Saxons, Hertfordshire was included partly in Mercia and partly in Essex. It was the scene of frequent contests between the Saxons and the Danes. In 896 the Danes, having anchored their vessels in the Lea near the town of Ware, laid siege to Hertford, whereupon Alfred the Great, by dividing the stream into three channels, stranded their vessels and compelled them to retreat to the Severn. After the battle of Senlac in 1066, William the Conqueror, in order to force the earls to hurry home from London to their earldoms, crossed the Thames at Wallingford and marched into Hertfordshire, where at Berkhamstead an attempt was made by the abbot of St. Albans to stop his course by cutting down the trees; and at a meeting of nobles held at the town he took an oath to rule according to the ancient laws and customs of the country. The subsequent events of historic importance connected with the county are the capture of Hertford castle by the revolted barons under the French dauphin, December 6, 1216; the battle between the royalists and the the armies of the White Rose at St. Albans, May 22, 1455, in which Henry VI. was wounded and taken prisoner; a second battle near St. Albans, February 17, 1461, in which the earl of Warwick was defeated by Queen Margaret; the defeat near Barnet of the earl of Warwick by Edward IV., April 14, 1471; and the arrest by Cromwell of the high sheriff of the county as he was proceeding to St. Albans for the purpose of proclaiming by order of Charles I. that all the Parliamentary commanders were rebels and traitors.

Among the objects of antiquarian interest may be mentioned the cave of Royston, re-discovered in 1742, doubtless at one time used as a hermitage, and containing rude carvings of the crucifixion and other sacred subjects; Waltham cross, in the pointed style of architecture, (restored in 1833), erected to mark the spot where rested the body of Eleanor, Queen of Edward I., on its way to Westminster for interment; and the Great Bed of Ware referred to in Shakespeare's *Twelfth Night*, for many years shown to visitors at the Crown Inn of that town, and in September, 1864, put up to auction at the Saracen's Head for 100 guineas and bought in. The principal monastic buildings are the noble pile of St. Albans abbey, founded about 793 in honor of the great Christian martyr of Great Britain; the remains of Sopwell Benedictine nunnery near St. Albans, founded in 1140; the remains of the priory of Ware, dedicated to St. Francis, and originally a cell to the monastery of St. Ebrulf, at Utica in Normandy; and the remains of the priory at Hitchin built by Edward II. for the White Carmelites. Among the more interesting churches may be mentioned those of Abbots Langley and Hemel-Hempstead, both of late Norman architecture; Baldock

a handsome Gothic building supposed to have been erected by the Knights Templars in the reign of Stephen; Royston, formerly connected with the priory of the canons regular; Hitchin, built in the fifteenth century on the site of an older structure, with a fine porch in the perpendicular style and an altar piece by Rubens; Hatfield, dating from the thirteenth century; Berkhamstead, chiefly in the perpendicular style, with a tower of the sixteenth century. The ruins of secular buildings of importance are the massive remains of Berkhamstead castle, Hertford castle, Hatfield palace, the slight traces at Bishop Stortford, and the earthworks at Anstie. Of the numerous mansions of interest only a few can be mentioned: The Rye House, erected in the reign of Henry VI., tenanted by Rumbold, one of the principal agents in the plot to assassinate Charles II.; Moor Park, Rickmansworth, at one time the property of St. Albans abbey, granted by Henry the VII. to John de Vere, earl of Oxford, for some time in the possession of Cardinal Wolsey and subsequently of the duke of Monmouth, who built the present mansion, which, however, after it was sold by the duchess of Monmouth to Mr. Styles, was cased with Portland stone, and received various other additions at a cost of £150,000; Knebworth, the seat of the Lyttons, originally a Norman fortress, rebuilt in the time of Elizabeth in the Tudor style, and restored in the present century; Hatfield House, the manor of which was granted to the abbey of St. Ethelred at Ely by King Edgar, and with the palace was made over to Henry VIII., from whose reign it remained a royal residence until the time of James I., who exchanged it for the palace of Theobalds with Sir Robert Cecil, afterward earl of Salisbury, by whom the present mansion in the Elizabethan style was erected, being founded in 1611; Panshanger House, now the principal seat of the Cowpers, a splendid mansion in the Gothic style erected at the beginning of the present century; Cashiobury House, the seat of the earls of Essex, supposed to derive its name from the old British tribe Cassii, and the manor of which was formerly held by the abbot of St. Albans, rebuilt in the beginning of the present century from designs by Wyatt, somewhat resembling those of Windsor Castle; Gorbamby House, formerly the seat of the Bacons, and the residence of the great chancellor, but rebuilt by the Grimstons. Among the eminent persons connected with the county were Nicholas Brakespeare (Pope Adrian IV.), Francis Bacon, Sir John Mandeville, William Cowper, Charles Lamb, and Lord Lytton.

MONTGOMERY, a city of the United States, the capital of Alabama, is built on a high bluff on the left bank of the Alabama River, 158 miles northeast of Mobile, with which it is connected by rail (180 miles) and by steamboat service (330 miles). The State House, rebuilt in 1851 at a cost of \$75,000, occupies a commanding site on Capitol Hill. There are a city hall, a court-house, and two theaters; a large flour mill, a cotton factory, two oil mills, a fertilizer factory, and several foundries and machine shops. The population was 16,713 in 1880; and in consequence of the marked increase in commercial and industrial activity since that date, it is now (1883) estimated at 19,000. Founded in 1817, and named after Gen. Richard Montgomery (1736-1775) the town of Montgomery became, in 1847, the seat of the State government instead of Tuscaloosa. From February, 1861, to March, 1862, it was the capital of the Southern Confederation. In 1865 it was seized by the Federal forces under General Wilson.

MONTGOMERY, the county seat of Montgomery county and capital of the State of Alabama, stands on the left bank of the Alabama river, on a pleasant, hilly site, 175 feet above sea-level. It is 158 miles northeast of Mobile, and has steamboat connections with that city and the Gulf of Mexico. Six railway lines pass through or have their termini in Montgomery, thus making it the receiving and distributing center for a large section of productive country. The city was founded in 1817, and was named after Gen. Richard Montgomery, who was killed at Quebec in 1775. In 1847 the State capital was transferred from Tuscaloosa to Montgomery, where a State capitol, one of the handsomest in the South, was erected for the accommodation of the executive and legislature. Other important buildings are the Federal offices and postoffice, the Masonic temple, two fine theaters, and thirteen hotels. There are two national and five other banks. The city has a first-class fire department, maintained at an expense (1889) of \$10,192. The police department consists of twenty-six officers and men, and cost \$24,037 in 1889. The city has grown very rapidly since the war, and now has a population (1900) of 30,346. Its bonded debt is \$722,050; annual receipts for 1889 were \$336,424, expenditures during same period, \$267,789. There is a good public-school system, with an appropriation last year of \$20,410, and expenditures of \$17,417. There are five schools, three for whites and two for blacks, with an enrollment of 992 white and 543 colored pupils. Pickett Springs Park, four miles from the court-house, is the principal park, and there is a handsome city cemetery.

Montgomery is notable in history as the city in which on February 4, 1861, delegates of the seceding States met to organize the Confederacy. Howell Cobb presided, and on the 9th the convention organized a Provisional Government under the title of "the Confederate States of America." Jefferson Davis, of Mississippi, and Alexander H. Stephens, of Georgia, were respect-

ively elected Provisional President and Vice-President of the newly-constituted government. Montgomery became the capital of the Confederacy, and so remained until the seat of government was transferred to Richmond, Va.

2. Another important point worthy of careful notice, is the attention paid in this work to the lives and works of men still living. The original *Encyclopædia Britannica* made it a rule not to deal biographically with living men, proceeding, probably, on the theory that a story ought to be finished before it is told. It is not designed to discuss the wisdom of this policy. A shrewd critic has said that "it is the good fortune of many dogs to be transformed into lions when they are dead." Solomon said, "A living dog is better than a dead lion." The AMERICANIZED ENCYCLOPÆDIA BRITANNICA has pursued another course. It deals with living leaders of men the wide world over — leaders in all departments of life — legislators, judges, religious teachers, authors, artists, men of conscience, travelers, political and social reformers, and the great host of noble men and women whose lives exalt and enrich the age in which they live.

This course is taken, not because it is thought to be due to the living not to be wholly ignored while they live, and then unduly magnified when they are dead; but because of the conviction that there is a growing spirit of appreciation among the people at large of great and worthy men and women. The lives of legislators and statesmen, of poets and painters, of the thinkers and toilers, of philanthropists and social reformers, are precious in the sight of the people, and they desire, from a motive somewhat higher than mere curiosity, to know all that can be wisely told of the great men and women of the hour.

3. Another point of importance in connection with the AMERICANIZED ENCYCLOPÆDIA BRITANNICA is the fact that it is now more than twenty-six years since the first volume of the ninth and latest edition of the *Encyclopædia Britannica* was issued. Those years have been among the most stirring times of the history of America, and of the world. The years of the century now closed, and of the century just opened grow richer in events of transcendent interest. This work — to use a phrase that is somewhat crude, but has the advantage of being thoroughly intelligible — is compiled "up to date," and may therefore indulge the claim of being a faithful chronicler of current events. It is rich in brief records of the important doings of the hour. It deals not only with what has been, but with what is. The growth, the development, the changes that fill these modern days with new meanings, are not permitted to pass unnoticed in these pages.

4. It is hardly necessary to say that, in the very important tasks of revising, condensing and amending, men of the very highest ability have been engaged, who have devoted themselves to their work with an enthusiasm only equaled by their untiring patience; impelled, no doubt, by the conviction that it was well worth while to consecrate skill and labor and time without measure, on a work that when

completed will not only be a monument of cultured toil, but one of the grandest literary treasures of the age, and a priceless legacy to America for all coming years. Of all work of brain or tongue, of hand or pen, such a work as the AMERICANIZED ENCYCLOPÆDIA BRITANNICA should be done well or not at all. The toilers on this masterpiece of compact and concentrated knowledge have brought rare ability to their tasks, at which they have patiently wrought to the last particle of their power.

5. Special attention has been paid in this work to the rise and growth of cities; a subject as interesting as it is important in a land where the sudden birth and wonderful growth of a community, is coming to be, not the exception, but almost the general order. America has seen the fulfillment, in spirit, at least, of the promise of the Hebrew seer: "A nation shall be born in a day." In more than one instance this country has seen a community spring up in a single generation, greater than Rome could boast in her most palmy days. An encyclopædia to be worthy of the name must keep careful record of these marvels of civic growth. This work takes in its wide sweep the whole of North America.

6. In consonance with the general plan of this great work, especial attention has been devoted to the development of scientific research and commercial progress in the United States during the last ten years. All statistics of population, exports, imports and manufactures have been brought up to date, and the most recent improvements in all branches of mechanics and applied science, such as the telephone, electric light, etc., as well other results of inventive genius, have been carefully noted.

7. In the special article upon the UNITED STATES the most recent data upon all these and cognate subjects will be found grouped. The multitude of new inventions, and the rapid movement of events has necessitated this arrangement, and as an aid to the reader, a copious and exhaustive index to the whole article upon the UNITED STATES will be found at the end of that article. By this arrangement the reader will be able to refer to any of these subjects without the slightest difficulty.

8. Another important element of worth in the AMERICANIZED ENCYCLOPÆDIA BRITANNICA, is its fine array of maps. It is impossible to exaggerate the value of a good set of maps in such a work as this. These maps, ninety-six in number, are from the establishment of Rand, McNally & Co., who are universally acknowledged to be the highest authorities on the subject. These maps have all been recently revised.

It was thought not long ago that the only appropriate place for the encyclopædia was in the public library, or the libraries of universities and colleges, and of those whose lives were devoted to education or to literature. But the world moves on. The leaven of education has worked mightily. The homes that a

generation ago were content with a handful of books and a weekly newspaper, are now ambitious for a library if only of modest dimensions. And this ambition will grow ; the shadow does not go backward on the dial. The taste and culture that demand a library will need an encyclopædia. Public men, public teachers, orators, writers, and all those engaged in any way in educational and literary affairs know that a good encyclopædia is worth more than its weight in gold. But **an** encyclopædia need no longer be the luxury of the wealthy and the learned.

Every household in the land would be immeasurably richer in the possession of the AMERICANIZED ENCYCLOPÆDIA BRITANNICA. In the ordinary course of daily life, a thousand questions arise that are difficult to answer, and at best the answers we get are little more than guesses. But this great treasure of knowledge answers all questions reliably and with a ready will. In the better days at hand the wise American will be content with furniture that is not of the carved and costly sort, if perchance he may become possessed of that most desirable piece of furnishing—for books are ever the best furniture—that combines the beautiful and the useful—a copy of the AMERICANIZED ENCYCLOPÆDIA BRITANNICA.

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AMERICANIZED ENCYCLOPÆDIA BRITANNICA.

VOLUME I.

A

A, THE first symbol of every Indo-European alphabet, bet, denotes also the primary vowel sound. This coincidence is probably only accidental. The alphabets of Europe, and perhaps of India also, were of Semitic origin, and in all the Semitic alphabets except one, this same symbol (in modified forms) holds the first place; but it represents a peculiar breathing, not the vowel *a*,—the vowels in the Semitic languages occupying a subordinate place, and having originally no special symbols. When the Greeks borrowed the alphabet of Phœnicia, they required symbols to express those vowels, and used for this purpose the signs of breathings which were strange to them, and therefore needed not to be preserved; thus the Phœnician equivalent of the Hebrew *aleph* became *alpha*; it denoted, however, no more a guttural breathing, but the purest vowel sound. Still, it would be too much to assume that the Greeks of that day were so skilled in phonetics that they assigned the first symbol of their borrowed alphabet to the *a*-sound, *because they knew that sound to be the most essential vowel*.

Now, we do not assert that there ever was a time when *a* was the only existing vowel, but we do maintain that in numberless cases an original *a* has passed into other sounds, whereas the reverse process is exceedingly rare. Consequently, the farther we trace back the history of language, the more instances of this vowel do we find; the more nearly, if not entirely, does it become the one starting point from which all vowel-sound is derived.

It is principally to the effort required to keep this sound pure that we must attribute the great corruption of it in all languages, and in none more than our own. Indeed, in English, the short *a*-sound is never heard pure; it is heard in Scotland, *e.g.*, in *man*, which is quite different from the same word on English lips. We have it, however, long in *father*, &c., though it is not common. It has passed into a great many other sounds, all of which are denoted in a most confusing way by the original symbol, and some by other symbols as well.

As in English, so in Sanskrit, the short *ak*-sound was

lost, and was replaced regularly by the neutral sound. In Latin the sound was probably pure, both short and long, and it has been preserved so in the Romance languages down to the present day. In Greek there was considerable variation, proved in one case at least by a variation of symbol; in Ionic *a* commonly passed into *η*, a symbol which probably denoted the modern Italian open *e*; but possibly the close *e*, that is, the English *a* in *ale*.

A is frequently used as a prefix in lieu of some fuller form in old English. Thus it stands for the preposition *on* (O.E. *an*) in *away*, *again*, *afoot*, *asleep*; for *off* in *adown* (O.E. *of-dune*); and seems to be intensive in *athirst* (O.E. *of-thirst*). Sometimes, especially with verbs, it represents the old English *d*, which in old High German appears as *ur* or *er*, and in modern German as *er*, which signifies the completion of the action, as in *erwachen*, to which *awake* corresponds.

The place that *A* occupies in the alphabet accounts for its being much employed as a mark or symbol. It is used, for instance, to name the sixth note of the gamut in music; in some systems of notation it is a numeral (see ARITHMETIC); and in Logic it denotes a universal affirmative proposition (see LOGIC). In algebra, *a* and the first letters of the alphabet are employed to represent known quantities.

A was the first of the eight *litera nundinales* at Rome, and on this analogy it stands as the first of the seven Dominical letters.

It is often used as an abbreviation, as in *A. D.* for *anno domini*, *A. M.* for *ante meridiem*, *A. B.* and *A. M.* for *artium baccalaureus* and *artium magister*. In commerce *A* stands for *accepted*.

AA, the name of about forty small European rivers. The word is derived from the old German *aha*, cognate to the Latin *aqua*, water.

AACHEN. See AIX-LA-CHAPELLE.

AALBORG, a city and seaport of Denmark, is situated on the Liimfiord, about 15 miles from its junction with the Cattegat. Soap, tobacco and leather are man-

ufactured; there are several distilleries; and the herring fishery is extensively prosecuted. Grain and herrings are largely exported, as are also to a smaller extent wool, cattle, skins, tallow, salt provisions, and spirits.

AALÉN, a walled town of Würtemberg, pleasantly situated on the Kocher, at the foot of the Swabian Alps, about 50 miles E. of Stuttgart. Population, 7,000.

AALI PASHA, born at Constantinople in 1815, became a clerk in the Turkish foreign office and in 1844 was made ambassador at London. Under the Sultans Abdul-Medjid and Abdul-Aziz he served as grand vizier and was instrumental in promoting reforms. He suppressed the Cretan rebellion in 1867-68, and died September 6, 1871.

AAR or AARE, the most considerable river in Switzerland, after the Rhine and Rhone.

AARD-VARK (*earth-pig*), an animal very common in South Africa, measuring upwards of three feet in length, and having a general resemblance to a short-legged pig. It feeds on ants, and is of nocturnal habits, and very timid and harmless. Its flesh is used as food, and when suitably preserved is considered a delicacy.

AARD-WOLF, a South African carnivore, fox-like in size and habit, and resembling the hyæna in its markings. It feeds on carrion and white ants, but not on living vertebrates.

AARGAU, the chief town of the canton of Aargau in Switzerland, is situated at the foot of the Jura mountains, on the right bank of the river Aar, 41 miles N.E. of Bern. Population, 76,000.

AARGAU (French ARGOVIE) one of the cantons of Switzerland, derives its name from the river which flows through it, Aar-gau being the province or district of the Aar. Area, 503 sq. m. Population, 200,000.

AARHUUS, a city and seaport of Denmark, situated on the Cattegat, in lat. 56° 9' N., long 10° 12' E. It is the chief town of a fertile district of the same name, one of the subdivisions of Jutland. It has a good and safe harbor, has regular steam communication with Copenhagen, and is connected by rail with Viborg and the interior of the country. Agricultural produce, spirits, leather, and gloves are exported, and there are sugar refineries, and manufactories of wool, cotton, and tobacco. Population (1901), 51,814.

AARON, the first high-priest of the Jews, eldest son of Amram and Jochebed, of the tribe of Levi, and brother of Moses and Miriam.

AARON'S BEARD, a popular name for several cultivated plants, of which the best-known are *Saxifraga sarmentosa*, plant with long drooping runners; and the common *Hypericum*, commonly known as the "Rose of Sharon."

AARSENS, FRANCIS VAN (1572-1641), one of the greatest diplomatists of the United Provinces. He represented the States-General at the Court of France for many years, and was also engaged in embassies to Venice, Germany, and England. His great diplomatic ability appears from the memoirs he wrote of his negotiations in 1624 with Richelieu, who ranked him among the three greatest politicians of his time. A deep stain rests on the memory of Aarsens from the share he had in the death of Barneveldt, who was put to death by the States-General, after a semblance of a trial, in 1619.

ABABDE, an African tribe occupying the country between the Red Sea and the Nile, to the S. of Kossere, nearly as far as the latitude of Derr. Many of the race have settled on the eastern bank of the Nile, but the greater part still live like Bedouins.

ABACA or ABAKA, a name given to the *Musa textilis*, the plant that produces the fibre called Manilla Hemp, and also to the fibre itself.

ABACUS, an architectural term applied to the upper

part of the capital of a column, pier, etc. The early form of an abacus is simply a square, flat stone, probably derived from the Tuscan order. In Saxon work it is frequently simply chamfered, but sometimes grooved. The abacus in Norman work is square where the columns are small; but on large piers it is sometimes octagonal.

ABACUS also signifies an instrument employed by the ancients for arithmetical calculations; pebbles, bits of bone, or coins, being used as counters.

ABADDON, the Hebrew word for "destruction," used in Job as an equivalent for Sheol. In the Apocalypse Abaddon is a synonym for APOLLYON, (*q.v.*)

ABÆ, a town of ancient Greece in the E. of Phocis, famous for a temple and oracle of Apollo. The temple was plundered and burned by the Persians (B.C. 480), and again by the Bœotians (B.C. 346), and was restored on a smaller scale by Hadrian.

ABAKANSK, a fortified town of Siberia, in the government of Yeniseisk, on the river Abakan, near its confluence with the Yenisei. This is considered the mildest and most salubrious place in Siberia, and is remarkable for the tumuli in its neighborhood, and for some statues of men from seven to nine feet high, covered with hieroglyphics.

ABANA and PHARPAR, "rivers of Damascus," are now generally identified with the Barada and the Awaj, respectively. The former flows through the city of Damascus; the Awaj passes eight miles to the south.

ABANCAY, a town of Peru, in the department of Cuzco, 65 miles W.S.W. of the town of that name. Rich crops of sugar-cane are produced in the district, and the town has extensive sugar refineries. Hemp is also cultivated, and silver is found in the mountains.

ABANDONMENT, in *Marine Assurance*, is the surrendering of the ship or goods insured to the insurers, in the case of a constructive total loss of the thing insured. There is an absolute total loss entitling the assured to recover the full amount of his insurance wherever the thing insured has ceased to exist to any useful purpose. Where the thing assured continues to exist in specie, yet is so damaged that there is no reasonable hope of repair, or it is not worth the expense of bringing it, or what remains of it, to its destination, the insured may treat the case as one of a total loss, and demand the full sum insured. But, as the contract of insurance is one of indemnity, the insured must, in such a case, make an express cession of all his rights to the recovery of the subject insured to the underwriter by abandonment. The insured must intimate his intention to abandon, within a reasonable time after receiving correct information as to the loss; any unnecessary delay being held as an indication of his intention not to abandon.

ABANDONING a child under two years of age, so that its life shall be endangered, or its health permanently injured, or likely to be so, is a misdemeanor, punishable by imprisonment. In the United States the grade of the offense and its punishment vary in the several States.

ABANDONMENT of either husband or wife is, in some of the States of the Union, valid ground of divorce.

ABANO, a town in Northern Italy, 6 miles S.W. of Padua. There are thermal springs in the neighborhood, which have been much resorted to by invalids for bathing, both in ancient and modern times. Pop., 5,000.

ABANO, PIETRO D', known also as *Petrus de Apono* or *Aponensis*, a distinguished physician and philosopher, was born at the Italian town from which he takes his name, in 1250, or, according to others, in 1246. After visiting the East, he went to study at Paris, where he became a doctor of medicine and philosophy. In Padua to which he returned when his studies were completed, he

speedily gained a great reputation as a physician, and availed himself of it to gratify his avarice by refusing to visit patients except for an exorbitant fee. Perhaps this, as well as his meddling with astrology, caused the charge to be brought against him of practising magic. He was twice brought to trial by the Inquisition; on the first occasion he was acquitted, and he died (1316) before the second trial was completed.

ABARIS, the Hyperborean, a celebrated sage of antiquity, who visited Greece about 570 B.C., or, according to others, a century or two earlier.

ABATEMENT, ABATE, from the French *abattre*, *abater*, to throw down, demolish. The original meaning of the word is preserved in various legal phrases. The abatement of a nuisance is the remedy allowed by law to a person injured by a public nuisance of destroying or removing it by his own act, provided he commit no breach of the peace in doing so.

Abatement of freehold takes place where, after the death of the person last seized, a stranger enters upon lands before the entry of the heir or devisee, and keeps the latter out of possession.

Abatement among legatees (*defalcatis*) is a proportionate deduction which their legacies suffer when the funds out of which they are payable are not sufficient to pay them in full.

Abatement in pleading is the defeating or quashing of a particular action by some matter of fact, such as a defect in form or personal incompetency of the parties suing, pleaded by the defendant. Such a plea is called a plea in abatement; and as it does not involve the merits of the cause, it leaves the right of action subsisting.

In litigation an action is said to abate or cease on the death of one of the parties.

ABATEMENT, or REBATE, is a discount allowed for prompt payment; it also means a deduction sometimes made at the custom-house from the fixed duties on certain kinds of goods, on account of damage or loss sustained in warehouses.

ABATI, or DELL'ABBATO, NICCOLO, a celebrated fresco-painter of Modena, born in 1512. His best works are at Modena and Bologna, and have been highly praised by Zanotti, Algoratti and Lanzi. He accompanied Primaticcio to France, and assisted in decorating the palace at Fontainebleau (1552-1571). Abati died at Paris in 1571.

ABATTOIR, from *abattre*, primarily signifies a slaughter-house proper, or place where animals are killed as distinguished from *boucheries* and *étaux publics*, places where the dead meat is offered for sale. But the term is also employed to designate a complete meat market, of which the abattoir proper is merely part.

Perhaps the first indication of the existence of abattoirs may be found in the system which prevailed under the Emperors in ancient Rome. A corporation or guild of butchers undoubtedly existed there, which delegated to its officers the duty of slaughtering the beasts required to supply the city with meat. The establishments requisite for this purpose were at first scattered about the various streets, but were eventually confined to one quarter, and formed the public meat market. As the policy and customs of the Romans made themselves felt in Gaul, the Roman system of abattoirs, was introduced there in an imperfect form. A clique of families in Paris long exercised the special function of catering for the public wants in respect of meat. But as the city increased in magnitude and population, the necessity of keeping slaughter-houses as much as possible apart from dwelling-houses became apparent. As early as the time of Charles IX., the attention of the French authorities was directed to the subject, as is testified by a decree passed on the 25th of

February 1567. No definite step seems to have been taken until the time of Napoleon I. The evil had then reached a terribly aggravated form. The constant accumulation of putrid offal tainted the atmosphere, and the Seine was polluted by being used as a common receptacle for slaughter-house refuse. This condition of things could not be allowed to continue, and on the 9th of February 1810, a decree was passed authorising the construction of abattoirs in the outskirts of Paris.

The abattoirs are situated within the barriers, each at a distance of about a mile and three-quarters from the heart of the city, in districts where human habitations are still comparatively few.

The Paris abattoirs were, until recently, the most perfect specimens of their class; and even now, although in some of their details they have been surpassed by the new London meat market, for their complete and compact arrangement, they remain unrivalled in Europe.

The condition of London in this important sanitary respect was, for a long period, little more endurable than that of Paris before the adoption of its reformed system. Smithfield market, situated in a very populous neighborhood, continued till 1852 to be an abomination to the town, and a standing reproach to its authorities. No fewer than 243,537 cattle and 1,455,249 sheep were sold there in 1852, to be afterwards slaughtered in the crowded courts and thoroughfares of the metropolis. But public opinion at length forced the Legislature to interfere, and the corporation was compelled to abandon Smithfield market, and to provide a substitute for it elsewhere.

The site selected for the market was in the suburb of Islington. It occupies a space of some twenty acres on the high land near the Pentonville prison, and is open to both native and foreign cattle, excepting beasts from foreign countries under quarantine.

The Edinburgh abattoir, erected in 1851 by the corporation, from designs prepared by Mr. David Cousin, the city architect, is the best as regards both construction and management in the United Kingdom. It occupies an area of four acres and a quarter, surrounded by a screen-wall, from which, along the greater part of its length, the buildings are separated by a considerable open space. In America, the immense packing-houses of Chicago, Cincinnati, Kansas City, St. Joseph, and other Western cities, represent the largest and best equipped abattoirs in the world. Here the animals are slaughtered in quantities not only sufficient for home consumption, but an immense domestic and foreign export business is carried on, both in fresh meats in bulk (which are transported in refrigerators), and in salted and packed meats. No portions of the animal product are wasted, even the offal being manufactured, and having commercial value.

ABAUZIT, FIRMIN, a learned Frenchman, was born of Protestant parents at Uzès, in Languedoc, in 1679. His father, who was of Arabian descent, died when he was but two years of age; and when, on the revocation of the Edict of Nantes in 1685, the authorities took steps to have him educated in the Roman Catholic faith, his mother contrived his escape. Abauzit's youth was spent in diligent study, and at an early age he acquired great proficiency in languages, physics, and theology. In 1698 he was introduced to Sir Isaac Newton, who found in him one of the earliest defenders of the great truths his discoveries disclosed to the world. The reputation of Abauzit induced William III. to request him to settle in England, but he did not accept the king's offer, preferring to return to Geneva. There, from 1715, he rendered valuable assistance to a society that had been formed for translating the New Testament into French. He declined the offer of the chair of philosophy in the

University in 1723, but accepted, in 1727, the sinecure office of librarian to the city of his adoption. Here he died at a good old age, in 1767.

ABB, a town of Yemen in Arabia, situated on a mountain in the midst of a very fertile country, 73 miles N.E. of Mocha. The population is about 5000.

ABBADIE, JAMES, an eminent Protestant divine, was born in Switzerland about 1657. His parents were poor, but through the kindness of discerning friends, he received an excellent education. He prosecuted his studies with such success, that on completing his course at Sedan, though only seventeen years of age, he had conferred on him the degree of doctor in theology. He died in London in 1727. Abbadie was a man of great ability and an eloquent preacher, but is best known by his religious treatises, several of which were translated from the original French into other languages, and had a wide circulation all over Europe.

ABBAS I., surnamed **THE GREAT**, one of the most celebrated of the sovereigns of Persia, was the youngest son of Shah Mohammed Khodabendeh. After heading a successful rebellion against his father, and causing one of his brothers (or, as some say, both) to be assassinated, he obtained possession of the throne at the early age of eighteen (1585). When he died in 1628, his dominions reached from the Tigris to the Indus. Abbas distinguished himself, not only by his successes in arms, and by the magnificence of his court, but also by his reforms in the administration of his kingdom.

ABBAS MIRZA (b. 1785, d. 1833), Prince of Persia, third son of the Shah Feth Ali, was destined by his father to succeed him in the government, because of his mother's connection with the royal tribe of the Khadjars. He led various expeditions against the Russians, but generally without success. By a treaty made between Russia and Persia in 1828, the right of Abbas to the succession was recognized.

ABBAS PASHA, grandson of the famous Mehemet Ali, was born in 1813, and became viceroy of Egypt in 1843 on the death of his uncle, Ibrahim Pasha. During his reign of six years he opposed all reforms, and on July 13, 1854, he was found dead, the supposition being that he was murdered.

ABBASSIDES, the caliphs of Baghdad, the most famous dynasty of the sovereigns of the Mahometan or Saracen empire. They derived their name and descent from Abbas (b. 566, d. 652 A.D.), the uncle and adviser of Mahomet, and succeeded the dynasty of the Ommiads, the caliphs of Damascus. Early in the 8th century the family of Abbas had acquired great influence from their near relationship to the Prophet; and Ibrahim, the fourth in descent from Abbas, supported by the province of Khorasan, obtained several successes over the Ommiad armies, but was captured and put to death by the Caliph Merwan (747). Ibrahim's brother, Abul-Abbas, whom he had named his heir, assumed the title of caliph, and, by a decisive victory near the river Zab (750), effected the overthrow of the Ommiad dynasty. Merwan fled to Egypt, but was pursued and put to death, and the vanquished family was treated with a severity which gained for Abul-Abbas the surname of Al-Saffah, the Blood-shedder. From this time the house of Abbas was fully established in the government, but the Spanish provinces were lost to the empire by the erection of an independent caliphate of Cordova, under Abderrahman.

On the death of Abul-Abbas, Almansur succeeded to the throne, and founded Baghdad as the seat of empire. He and his son Mohdi waged war successfully against the Turkomans and Greeks of Asia Minor; but from this time the rule of the Abbassides is marked rather by the development of the liberal arts than by extension of territory. The strictness of the Mohammedan religion

was relaxed, and the faithful yielded to the seductions of luxury.

The territory of the Abbassides soon suffered dismemberment, and their power began to decay. Province after province proclaimed itself independent; the caliph's rule became narrowed to Baghdad and its vicinity; and the house of Abbas lost its power in the East for ever. The last of them, Motawakkel III., was taken by Sultan Selim I., the conqueror of Egypt, to Constantinople, and detained there for some time as a prisoner. He afterwards returned to Egypt, and died at Cairo a pensionary of the Ottoman government, in 1538.

ABBÉ is the French word corresponding to **ABBOT**, but, from the middle of the sixteenth century to the time of the French Revolution, the term had a wider application. The assumption by a numerous class of the name and style of abbé appears to have originated in the right conceded to the King of France, by a concordat between Pope Leo X. and Francis I., to appoint *abbés commendataires* to 225 abbeys, that is, to most of the abbeys in France. The *abbés commendataires* were not necessarily priests; the papal bull required indeed that they should take orders within a stated time after their appointment, but there seems to have been no difficulty in procuring relief from that obligation. The expectation of obtaining these sinecures drew young men towards the Church in considerable numbers, and the class of abbés so formed—*abbés de cour* they were sometimes called, and sometimes (ironically) *abbés de sainte espérance*, abbés of St. Hope—came to hold a recognised position, that perhaps proved as great an attraction as the hope of preferment.

ABBEOKUTA, or **ABEOKUTA**, a town of West Africa in the Yoruba Country, on the Ogun River, 50 miles north of Lagos, in a direct line, or 81 miles by water. It lies in a beautiful and fertile country, the surface of which is broken by masses of grey granite. Like most African towns, Abbeokuta is spread over an extensive area, being surrounded by mud walls, 18 miles in extent. The houses are also of mud, and the streets mostly narrow and filthy. There are numerous markets in which native products and articles of European manufacture are exposed for sale. Palm-oil and shea-butter are the chief articles of export, and it is expected that the cotton of the country will become a valuable article of commerce. The slave trade and human sacrifices have been abolished; but notwithstanding the efforts of English and American missionaries, the natives are still backward. There is now (1902), a railway from Lagos.

ABBESS, the female superior of an abbey or convent of nuns. The mode of election, position, rights, and authority of an abbess, correspond generally with those of an abbot. The office was elective, the choice being by the secret votes of the sisters from their own body. The abbess was solemnly admitted to her office by episcopal benediction, together with the conferring of a staff and pectoral, and held it for life, though liable to be deprived for misconduct.

By Celtic usage abbesses presided over joint-houses of monks and nuns. This custom accompanied Celtic monastic missions to France and Spain, even to Rome itself. At a later period, A.D. 1115, Robert, the founder of Fontevraud, committed the government of the whole order, men as well as women, to a female superior.

ABBEVILLE, a city of France, in the department of the Somme, is situated on the River Somme, 12 miles from its mouth in the English Channel, and 25 miles N.W. of Amiens. It lies in a pleasant and fertile valley, and is built partly on an island, and partly on both sides of the river. A cloth manufactory was established here by Van Robais, a Dutchman, under the

patronage of the minister Colbert, as early as 1669; and since that time Abbeville has continued to be one of the most thriving manufacturing towns in France. Besides black cloths of the best quality, there are produced velvets, cottons, linens, serges, sackings, hosiery, pack-thread, jewellery, soap and glass-wares. It has also establishments for spinning wool, print-works, bleaching-works, tanneries, a paper manufactory, &c.; and being situated in the centre of a populous district, it has a considerable trade with the surrounding country. Vessels of from 200 to 300 tons come up to the town at high-water. Population about 22,000.

ABBEY, a monastery, or conventual establishment, under the government of an ABBOT or an ABBESS. A *priory* only differed from an abbey in that the superior bore the name of *prior* instead of *abbot*.

The earliest Christian monastic communities with which we are acquainted consisted of groups of cells or huts collected about a common centre, which was usually the abode of some anchorite celebrated for superior holiness or singular asceticism, but without any attempt at orderly arrangement. The formation of such communities in the East does not date from the introduction of Christianity. The example had been already set by the Essenes in Judea and the Therapeutæ in Egypt, who may be considered the prototypes of the industrial and meditative communities of monks.

In the earliest ages of Christian monasticism the ascetics were accustomed to live singly, independent of one another, at no great distance from some village, supporting themselves by the labor of their own hands, and distributing the surplus after the supply of their own scanty wants to the poor. Increasing religious fervor, aided by persecution, drove them further and further away from the abodes of men into mountain solitudes or lonely deserts. The deserts of Egypt swarmed with the cells or huts of these anchorites.

The real founder of cœnobian monasteries in the modern sense was Pachomius, an Egyptian of the beginning of the 4th century. The first community established by him was at Tabennæ, an island of the Nile in Upper Egypt. Eight others were founded in his lifetime, numbering 3000 monks. Within 50 years from his death his societies could reckon 50,000 members.

Monasticism in the West owes its extension and development to Benedict of Nursia (born A.D. 480). His rule was diffused with miraculous rapidity from the parent foundation on Monte Cassino through the whole of Western Europe, and every country witnessed the erection of monasteries far exceeding anything that had yet been seen in spaciousness and splendor. Few great towns in Italy were without their Benedictine convent, and they quickly rose in all the great centres of population in England, France, and Spain. The number of these monasteries founded between A.D. 520 and 700 is amazing. Before the Council of Constance, A.D. 1005, no fewer than 15,070 abbeys had been established of this order alone.

The history of Monasticism is one of alternate periods of decay and revival. With growth in popular esteem came increase in material wealth, leading to luxury and worldliness. The first religious ardor cooled, the strictness of the rule relaxed, until by the 10th century the decay of discipline was so complete in France that the monks are said to have been frequently unacquainted with the rule of St. Benedict, and even ignorant that they were bound by any rule at all.

The reformation of these prevalent abuses generally took the form of the establishment of new monastic orders, with new and more stringent rules. One of the earliest of these reformed orders was the *Cluniac*. This order took its name from the little village of Clugny,

12 miles N. W. of Macon, near which, about A. D. 909, a reformed Benedictine abbey was founded by William, Duke of Auvergne, under Berno, abbot of Beaume. He was succeeded by Odo, who is often regarded as the founder of the order. The fame of Clugny spread far and wide. Its rigid rule was adopted by numbers of the old Benedictine abbeys, who placed themselves in affiliation to the mother society, while new foundations sprang up in large numbers, all owing allegiance to the "archabbot," established at Clugny. By the end of the 12th century the number of monasteries affiliated in the various countries of Western Europe amounted to 2000. The monastic establishment of Clugny was one of the most extensive and magnificent in France. The next great monastic revival, the Cistercian, arising in the last years of the 11th century, had a wider diffusion, and a longer and more honorable existence. Owing its real origin, as a distinct foundation of reformed Benedictines, in the year 1098, to an English ecclesiastic, Stephen Harding (a native of Dorsetshire, educated in the monastery of Sherborne), and deriving its name from Cîteaux (*Cistercium*), a desolate and almost inaccessible forest solitude, on the borders of Champagne and Burgundy, the rapid growth and wide celebrity of the order are undoubtedly to be attributed to the enthusiastic piety of St. Bernard, abbot of the first monastic colonies, subsequently set forth in such quick succession by the first Cistercian houses, the far-famed abbey of Clairvaux (de Clara Valle), A.D. 1116.

The rigid self-abnegation, which was the ruling principle of this reformed congregation of the Benedictine order, extended itself to the churches and other buildings erected by them. The characteristic of the Cistercian abbeys was the extreme simplicity and a studied plainness. Only one tower — a central one — was permitted, and that was to be very low. Unnecessary pinnacles and turrets were prohibited. The triforium was omitted. The windows were to be plain and undivided, and it was forbidden to decorate them with stained glass. All needless ornament was proscribed. The crosses must be of wood; the candlesticks of iron. The renunciation of the world was to be evidenced in all that met the eye. The same spirit manifested itself in the choice of the sites of their monasteries. The more dismal, the more savage, the more hopeless a spot appeared, the more did it please their rigid mood. But they came not merely as ascetics, but as improvers. The Cistercian monasteries are, as a rule, found placed in deep, well-watered valleys. They always stand on the border of a stream; not rarely, as at Fountains, the buildings extend over it. These valleys, now so rich and productive, were a very different aspect when the brethren first chose them as the place of their retirement. Wide swamps, deep morasses, tangled thickets, wild impassable forests, were their prevailing features. The "Bright Valley," *Clara Vallis* of St. Bernard, was known as the "Valley of Wormwood," infamous as a den of robbers. "It was a savage, dreary solitude, so utterly barren that at first Bernard and his companions were reduced to live on beech leaves.

The *Premonstratensian* regular canons, or White Canons, had as many as 35 houses in England, of which the most perfect remaining are those of Easby, Yorkshire, and Bayham, Sussex. The head house of the order in England was Welbeck. This order was a reformed branch of the Austin canons, founded A. D. 1119, by Norbert (born at Xanten on the Lower Rhine, c. 1080) at Prémontré, a secluded marshy valley in the forest of Goucy, in the diocese of Laon. The order spread widely. Even in the founder's lifetime it possessed houses in Syria and Palestine. It long maintained its rigid austerity, till in the course of years

wealth impaired its discipline, and its members sank into indolence and luxury. The Premonstratensians were brought to England shortly after A.D. 1140, and were first settled at Newhouse, in Lincolnshire, near the Humber.

The *Carthusian* order, on its establishment by St. Bruno, about A.D. 1084, developed a greatly modified form and arrangement of a monastic institution. The principle of this order, which combined the cenobitic with the solitary life, demanded the erection of buildings on a novel plan. This plan, which was first adopted by St. Bruno and his twelve companions at the original institution at Chartreux, near Grenoble, was maintained in all the Carthusian establishments throughout Europe, even after the ascetic severity of the order had been to some extent relaxed, and the primitive simplicity of their buildings had been exchanged for the magnificence of decoration which characterizes such foundations as the *Certosas* of Pavia and Florence. According to the rule of St. Bruno, all the members of a Carthusian brotherhood lived in the most absolute solitude and silence. Each occupied a small detached cottage, standing by itself in a small garden surrounded by high walls, and connected by a common corridor or cloister. In these cottages or cells a Carthusian monk passed his time in the strictest asceticism, only leaving his solitary dwelling to attend the services at the Church, except on certain days when the brotherhood assembled in the refectory.

ABBATE GRASSO, a town in the north of Italy, near the Ticino, 14 miles W.S.W. of Milan. It has silk manufactures, and contains about 5000 inhabitants.

ABBON OF FLEURY, or ABBO FLORIANCENSIS, a learned Frenchman, born near Orleans in 945. He distinguished himself in the schools of Paris and Rheims, and was a proficient in science, as known in his time. After spending two years in England, assisting Archbishop Oswald of York in restoring the monastic system, he returned to France, and was made Abbot of Fleury (970). He was twice sent to Rome by Robert the Wise (986, 996), and on each occasion succeeded in warding off a threatened papal interdict. He was killed in 1004, in endeavoring to quell a monkish revolt.

ABBOT, the head and chief governor of a community of monks, called also in the East *Archimandrita*, from *mandra*, "a fold," or *Hegumenos*. The name *abbot* is derived from the Hebrew, *Ab*, or *father*, through Syriac *Abba*. It had its origin in the monasteries of Syria, whence it spread through the East, and soon became accepted generally in all languages as the designation of the head of a monastery.

The name abbot, though general in the West, was not universal. Among the Dominicans, Carmelites, Augustines, &c., the superior was called *Priopositus*, "Provost," and *Prior*; among the Franciscans, *Custos*, "Guardian," and by the monks of Camaldoli, *Major*.

Monks, as a rule, were laymen, nor at the outset was the abbot any exception. All orders of clergy, therefore, even the "doorkeeper," took precedence of him. For the reception of the sacraments, and for other religious offices, the abbot and his monks were commanded to attend the nearest church. This rule naturally proved inconvenient when a monastery was situated in a desert, or at a distance from a city, and necessity compelled the ordination of abbots. This innovation was not introduced without a struggle, ecclesiastical dignity being regarded as inconsistent with the higher spiritual life; but, before the close of the 5th century, at least in the East, abbots seem almost universally to have become deacons, if not presbyters. The change spread more slowly in the West, where the office of abbot was com-

monly filled by laymen till the end of the 7th century, and partially so up to the 11th. Ecclesiastical Councils were, however, attended by abbots. Thus, at that held at Constantinople, A.D. 448, for the condemnation of Eutyches, 23 archimandrites or abbots sign, with 30 bishops, and, *cir.* A.D. 690, Archbishop Theodore promulgated a canon, inhibiting bishops from compelling abbots to attend councils. Examples are not uncommon in Spain and in England in Saxon times. Abbots were permitted by the Second Council of Nicæa, A.D. 787, to ordain their monks to the inferior orders. This rule was adopted in the West, and the strong prejudice against clerical monks having gradually broken down, eventually monks, almost without exception, belonged to some grade of the ministry.

Originally no abbot was permitted to rule over more than one monastic community, though, in some exceptional cases, Gregory the Great allowed the rule to be broken. As time went on, violations of the rule became increasingly frequent, as is proved by repeated enactments against it.

Abbots were originally subject to episcopal jurisdiction, and continued generally so, in fact, in the West till the 11th century. The *Codex of Justinian* expressly subordinates the abbot to episcopal oversight. The first case recorded of the partial exemption of an abbot from episcopal control, is that of Faustus, Abbot of Lerins, at the Council of Arles, A.D. 456; but the oppressive conduct, and exorbitant claims and exactions of bishops, to which this repugnance to episcopal control is to be traced, far more than to the arrogance of abbots, rendered it increasingly frequent, and, in the 6th century, the practice of exempting religious houses partly or altogether from episcopal control, and making them responsible to the Pope alone, received an impulse from Gregory the Great. These exceptions, though introduced with a good object, had grown into a widespread and crying evil by the 12th century, virtually creating an *imperium in imperio*, and entirely depriving the bishop of all authority over the chief centers of power and influence in his diocese. In the 12th century the abbots of Fulda claimed precedence of the Archbishop of Cologne. Abbots more and more aped episcopal state, and in defiance of the express prohibition of early councils, and the protests of St. Bernard and others, adopted the episcopal insignia of mitre, ring, gloves, and sandals. The adoption of episcopal insignia by abbots was followed by an encroachment of episcopal functions, which had to be specially but ineffectually guarded against by the Lateran Council, A.D. 1123. It was necessary that an abbot should be at least 25 years of age, of legitimate birth, a monk of the house, unless it furnished no suitable candidate, when a liberty was allowed of electing from another convent, well instructed himself, and able to instruct others, one also who had learned how to command by having practiced obedience. In some exceptional cases an abbot was allowed to name his own successor. Cassian speaks of an abbot in Egypt doing this; and in later times we have another example in the case of St. Bruno. Popes and sovereigns gradually encroached on the rights of the monks, until in Italy the Pope had usurped the nomination of all abbots, and the king in France, with the exception of Clugny, Prémontré, and other houses, chiefs of their order. The election was for life, unless the abbot was canonically deprived by the chiefs of his order, or, when he was directly subject to them, by the Pope or the bishop.

The ceremony of the formal admission of a Benedictine abbot in mediæval times is thus prescribed by the consuetudinary of Abington. The newly elected abbot was to put off his shoes at the door of the church,

and proceed barefoot to meet the members of the house advancing in a procession. After proceeding up the nave, he was to kneel and pray at the topmost step of the entrance of the choir, into which he was to be introduced by the bishop or his commissary, and placed in his stall. The monks, then kneeling, gave him the kiss of peace on the hand, and rising, on the mouth, the abbot holding his staff of office. He then put on his shoes in the vestry, and a chapter was held, and the bishop or his commissary preached a suitable sermon.

The power of the abbot was paternal but absolute, limited, however, by the canons of the church, and, until the general establishment of exemptions, by episcopal control. As a rule, however, implicit obedience was enforced; to act without his orders was culpable; while it was a sacred duty to execute his orders, however unreasonable, until they were withdrawn. Examples among the Egyptian monks of this blind submission to the commands of the superiors, exalted into a virtue by those who regarded the entire crushing of the individual will as the highest excellence, are detailed by Cassian and others—*e.g.*, a monk watering a dry stick, day after day, for months, or endeavoring to remove a huge rock immensely exceeding his powers.

The abbot was treated with the utmost submission and reverence by the brethren of his house. When he appeared either in church or chapter, all present rose and bowed. His letters were received kneeling, like those of the Pope and the king. If he gave a command, the monk receiving it was also to kneel. No monk might sit in his presence, or leave it without his permission. The highest place was naturally assigned to him, both in church and at table. In the East he was commanded to eat with the other monks. In the West the rule of St. Benedict appointed him a separate table, at which he might entertain guests and strangers. This permission opening the door to luxurious living, the Council of Aix, A.D. 817, decreed that the abbot should dine in the refectory, and be content with the ordinary fare of the monks, unless he had to entertain a guest. These ordinances proved, however, generally ineffectual to secure strictness of diet, and contemporaneous literature abounds with satirical remarks and complaints concerning the inordinate extravagance of the tables of the abbots.

The ordinary attire of the abbot was according to rule to be the same as that of the monks. But by the 10th century the rule was commonly set aside, and we find frequent complaints of abbots dressing in silk, and adopting great sumptuousness of attire. With the increase of wealth and power, abbots had lost much of their special religious character, and became great lords, chiefly distinguished from lay lords by celibacy. Thus we hear of abbots going out to sport, with their men carrying bows and arrows; keeping horses, dogs, and huntsmen; and special mention is made of an abbot of Leicester, *cir.* 1360, who was the most skilled of all the nobility in hare-hunting. In magnificence of equipage and retinue the abbots vied with the first nobles of the realm. They rode on mules with gilded bridles, rich saddles and housings, carrying hawks on their wrists, attended by an immense train of attendants. The bells of the churches were rung as they passed. They associated on equal terms with laymen of the highest distinction, and shared all their pleasures and pursuits. This rank and power was, however, often used most beneficially. For instance, we read of Whiting, the last Abbot of Glastonbury, that his house was a kind of well-ordered court, where as many as 300 sons of noblemen and gentlemen, who had been sent to him for virtuous education, had been brought up, besides others of a meaner rank, whom he fitted for the universities.

His table, attendance, and officers were an honor to the nation. He would entertain as many as 500 persons of rank at one time, besides relieving the poor of the vicinity twice a-week. He had his country houses and fisheries, and when he traveled to attend Parliament his retinue amounted to upwards of 100 persons. The abbots of Clugny and Vendome were, by virtue of their office, cardinals of the Romish Church.

Lay abbots, so called, had their origin in the system of *commendation*, in the 8th century. By this, to meet any great necessity of the state, such as an inroad of the Saracens, the revenues of monasteries were temporarily commended, *i.e.*, handed over to some layman, a noble, or even the king himself, who for the time became titular abbot. Enough was reserved to maintain the monastic brotherhood, and when the occasion passed away the revenues were to be restored to their rightful owners. The gross abuse of lay commendation which had sprung up during the corruption of the monastic system passed away with its reformation in the 10th century, either voluntarily or by compulsion. The like abuse prevailed in the East at a later period. John, Patriarch of Antioch, at the beginning of the 12th century, informs us that in his time most monasteries had been handed over to laymen, *beneficiarii*, for life, or for part of their lives, by the emperors.

ABBOT, CHARLES, speaker of the House of Commons from 1802 to 1817, afterwards created Lord Colchester. See COLCHESTER.

ABBOT, GEORGE, Archbishop of Canterbury, was born October 19, 1562, at Guildford in Surrey, where his father was a cloth-worker. He studied at Balliol College, Oxford, and was chosen Master of University College in 1597. He was three times appointed Vice-Chancellor of the University. In 1608 he went to Scotland with the Earl of Dunbar to arrange for a union between the Churches of England and Scotland, and his conduct in that negotiation laid the foundation of his preferment, by attracting to him the notice and favor of the king. Without having held any parochial charge, he was appointed Bishop of Lichfield and Coventry in 1609, was translated to the see of London a month afterwards, and in less than a year was made Archbishop of Canterbury. This rapid preferment was due as much perhaps to his flattering his royal master as to his legitimate merits. After his elevation he showed on several occasions firmness and courage in resisting the king. In the scandalous divorce suit of the Lady Frances Howard against the Earl of Essex, the archbishop persistently opposed the dissolution of the marriage, though the influence of the king and court was strongly and successfully exerted in the opposite direction. In 1618, when a declaration was published by the king, and ordered to be read in all the churches, permitting sports and pastimes on the Sabbath, Abbot had the courage to forbid its being read at Croydon, where he happened to be at the time. As may be inferred from the incident just mentioned, Abbot was of the Protestant or Puritan party in the Church. He was naturally, therefore, a promoter of the match between the Elector Palatine and the Princess Elizabeth, and a firm opponent of the projected marriage of the Prince of Wales with the Infanta of Spain. This policy brought upon him the hatred of Laud and the court. The king, indeed, never forsook him; but Buckingham was his avowed enemy, and was regarded with dislike by the Prince of Wales. He died in 1633.

ABBOT, GEORGE, known as "The Puritan," has been oddly and persistently mistaken for others. He has been described as a clergyman, which he never was, and as son of Sir Morris Abbot, and his writings accordingly entered in the bibliographical authorities as

by the nephew of the Archbishop of Canterbury. He was son or grandson (it is not clear which) of Sir Thomas Abbot. He was a member of the Long Parliament for Tamworth. As a layman, and nevertheless a theologian and scholar of rare ripeness and critical ability, he holds an almost unique place in the literature of the period. He died February 2, 1648.

ABBOTT, JACOB, born at Hallowell, Me., in 1803; died October 31, 1879. He was professor of mathematics at Amherst College, 1825-29, and subsequently a Congregational minister. He is chiefly known by his books for the young, of which he published over 200 volumes.

ABBOTT, ROBERT, a noted Puritan divine, who is surrounded by an atmosphere of uncertainty. He is supposed to have been born in 1588 or 1589. He wrote a good many hortative works for his parishioners, and was the beau ideal of the English country clergyman. He died, pastor of St. Augustine's, London, about 1662.

ABBOTSFORD, the celebrated residence of Sir Walter Scott, situated on the south bank of the river Tweed, about three miles above Melrose, Scotland.

ABBOTSFORD CLUB, one of the principal printing clubs of Scotland, was founded in 1834, and named in honor of Sir Walter Scott. It had fifty members.

ABBREVIATION, a letter or group of letters, taken from a word or words, and employed to represent them for the sake of brevity. Abbreviations, both of single words and phrases, having a meaning more or less fixed and recognized, are common in ancient writings and inscriptions, and very many are in use at the present time. A distinction is to be observed between abbreviations and the contractions that are frequently to be met with in old manuscripts, and even in early printed books, whereby letters are dropped out here and there, or particular collocations of letters represented by somewhat arbitrary symbols. The commonest form of abbreviation is the substitution for a word of its initial letter.

ABBREVIATORS, a body of writers in the Papal Chancery, whose business is to sketch out and prepare in due form the Pope's bulls, briefs, and consistorial decrees. They are first mentioned in a bull of Benedict XII., early in the 14th century. Their number is fixed at seventy-two, of whom twelve, distinguished as *de parco majori*, hold prelatial rank; twenty-two, *de parco minori*, are clergymen of lower rank; and the remainder, *examinatores*, may be laymen.

ABDALLATIF, or ABD-UL-LATIF, a celebrated physician and traveller, and one of the most voluminous writers of the East, was born in Baghdad in 1162. An interesting memoir of Abdallatif, written by himself, has been preserved with additions by Ibn-Abu-Osaiba, a contemporary.

ABD-EL-KADER, celebrated for his brave resistance to the advance of the French in Algeria, was born in Mascara, in the early part of the year 1807. His father was a man of great influence among his countrymen from his high rank and learning, and Abd-el-Kader himself, at an early age, acquired a reputation for wisdom and piety, as well as for skill in horsemanship and other manly exercises. In 1831 he was chosen Emir of Mascara, and leader of the combined tribes in their attempt to check the growing power of the French in Africa. His efforts were at first successful, and in 1834 he concluded a treaty with the French general, which was very favorable to his cause. War again broke out in 1839, and for more than a year was carried on in a very desultory manner. In 1841, however, Marshal Bugeaud assumed the chief command of the French force, which numbered nearly 100,000 men. The war was now carried on with great vigor, and Abd-el-Kader, after a most determined resistance, surrendered himself

to the Duc d'Aumale on the 22d December, 1847. The promise that he would be allowed to retire to Alexandria or St. Jean d'Acre, upon the faith of which Abd-el-Kader had given himself up, was broken by the French government. He was taken to France, and was imprisoned, first in the castle of Pau, and afterward in that of Amboise. In 1852, Louis Napoleon gave him his liberty, on condition of his not returning to Algeria. Since then he resided successively at Broussa, Constantinople and Damascus. He died at Damascus, Syria, May 26, 1883.

ABDERA (1), in *Ancient Geography*, a maritime town of Thrace, eastward from the mouth of the river Nestus. Mythology assigns the founding of the town to Hercules; but Herodotus states that it was first colonized by Timesias of Clazomenæ, whom the Thracians in a short time expelled.

ABDERA (2), a town in *Hispania Batia*, founded by the Carthaginians, on the south coast, between Malaca and Prom, probably the modern Adra.

ABDICATION, the act whereby a person in office renounces and gives up the same before the expiry of the time for which it is held. The word is seldom used, except in the sense of surrendering the supreme power in a state. Despotical sovereigns are at liberty to divest themselves of their powers at any time, but it is otherwise with a limited monarchy. The throne of Great Britain cannot be lawfully abdicated unless with the consent of the two Houses of Parliament. When James II., after throwing the Great Seal into the Thames, fled to France in 1688, he did not formally resign the crown, and the question was discussed in Parliament whether he had forfeited the throne or abdicated. The latter designation was finally agreed on in a full assembly of the Lords and Commons.

ABDOMEN, in *Anatomy*, the lower part of the trunk of the body, situated between the thorax and the pelvis. See ANATOMY.

ABDOMINALES, or ABDOMINAL FISHES, a subdivision of the Malacopterygious Order, whose ventral fins are placed behind the pectorals, under the abdomen. The typical abdominals are carp, salmon, herring, silures and pike.

ABDUCTION, a law term, denoting the forcible or fraudulent removal of a person, limited by custom to the case where a woman is the victim. In the case of men or children, it has been usual to substitute the term KIDNAPPING (*q.v.*)

ABDUL-AZIZ, sultan of Turkey, was born February 9, 1830, and succeeded his brother, Abdul-Medjid (see below) in 1861. He reigned for fifteen years, during the course of which the financial affairs of Turkey and the condition of the people grew daily more unbearable. On May 30, 1876, Abdul was forced to abdicate, and four days later he was killed in his own palace, it is supposed by his own ministers.

ABDUL MEDJID, Sultan of Turkey, the thirty-first sovereign of the house of Othman, was born April 23, 1823, and succeeded his father, Mahmoud II., on the 2d of July, 1839. Mahmoud appears to have been unable to effect the reforms he desired in the mode of educating his children, so that his son received no better education than that given, according to use and wont, to Turkish princes in the harem. When Abdul Medjid succeeded to the throne the affairs of Turkey were in an extremely critical state. At the very time his father died, the news was on its way to Constantinople that the Turkish army had been signally defeated at Nisib by that of the rebel Egyptian viceroy, Mehemet Ali; and the Turkish fleet was at the same time on its way to Egypt, to be surrendered perfidiously by its commander to the same enemy. But, through the interven-

of the great European powers, Mehmet Ali was obliged to come to terms, and the Ottoman empire was saved. In compliance with his father's express instructions, Abdul Medjid set at once about carrying out the extensive reforms to which Mahmoud had so energetically devoted himself. When Kossuth and others sought refuge in Turkey, after the failure of the Hungarian rising in 1849, the sultan was called on by Austria and Russia to surrender them, but boldly and determinedly refused.

À BECKET, THOMAS, Archbishop of Canterbury and Chancellor of England in the 12th century, was born in London on the 21st of December, 1118. His father, Gilbert Becket, and his mother Roesa or Matilda, were both, there can be little doubt, of Norman extraction, if indeed they themselves were not immigrants from Normandy to England. At ten years of age Thomas was placed under the tuition of the canons regular of Merton on the Wandle in Surrey. From Merton he proceeded to study in the London schools, then in high repute. At Pevensey Castle, the seat of his father's friend Richer de l'Aigle, one of the great barons of England, he subsequently became a proficient in all the feats and graces of chivalry. From Pevensey he betook himself to the study of theology in the University of Paris. He never became a scholar, much less a theologian, like Wolsey, or even like some of the learned ecclesiastics of his own day; but his intellect was vigorous and original, and his manners captivating to his associates and popular with the multitude. His father's failure in business recalled him to London, and for three years he acted as a clerk in a lawyer's office. But a man so variously accomplished could not fail to stumble on preferment sooner or later. Accordingly, about 1142, Archdeacon Baldwin, a learned civilian, a friend of the elder Becket, introduced him to Theobald, Archbishop of Canterbury, who at once appointed him to an office in the Archiepiscopal Court. His talents speedily raised him to the archdeaconry of the see. À Becket's tact in assisting to thwart an attempt to interest the Pope in favor of the coronation of Stephen's son Eustace, paved the way to the archdeacon's elevation to the Chancellorship of England under Henry II., a dignity to which he was raised in 1155. His pomp and munificence as chancellor were beyond precedent. In 1159 he undertook, at Henry's request, an embassy to the French Court for the purpose of affiancing the king's eldest son to the daughter of the king of France. His progress through the country was like a triumphal procession. "How wonderful must be the king of England himself whose chancellor travels in such state!" was on every one's lips. In 1162 he was elected Archbishop of Canterbury, Gilbert Foliot, Bishop of Hereford, alone dissenting, and remarking sarcastically, at the termination of the ceremony, that "the king had worked a miracle in having that day turned a layman into an archbishop and a soldier into a saint." Hitherto À Becket had only been in deacon's orders, and had made no profession of sanctity of life. At the same time, there is nothing to show that his character was stained by the gross licentiousness of the times. Now, however, he devoted himself body and soul to the service of the church. The fastidious courtier was at once transformed into the squalid penitent, who wore hair-cloth next to his skin, fed on roots, drank nauseous water, and daily washed the feet of thirteen beggars. Henry, who had expected to see the archbishop completely sunk in the chancellor, was amazed to receive the following laconic message from À Becket:—"I desire that you will provide yourself with another chancellor, as I find myself hardly sufficient for the duties of one office, much less of two." From that moment there was strife between À Becket and Henry, À Becket straining every nerve to extend the authority of the Pope, and Henry

doing his utmost to subject the church to his own will. Throughout the bitter struggle for supremacy which ensued between À Becket and the king, À Becket was backed by the sympathy of the Saxon populace, Henry by the support of the Norman barons and by the greater dignitaries of the church. At the outset À Becket was worsted. He was constrained to take an oath "with good faith and without fraud or reserve, to observe the Constitutions of Clarendon," which subjected clerks guilty of crime to the ordinary civil tribunals, put ecclesiastical dignities at the royal disposal, prevented all appeal to Rome, and made Henry the virtual "head of the church." For his guilty compliance with these anti-papal constitutions he received the special pardon and absolution of his holiness, and proceeded to anathematise them with the energy of a genuine remorse. The king resolved on his ruin. He was summoned before a great council at Northampton, and in defiance of justice was called to account for the sum of 44,000 marks declared to have been misappropriated by him during his chancellorship. He effected his escape to France, and took refuge in the Cistercian monastery of Pontigny, whence he repeatedly anathematized his enemies in England, and hesitated not to speak of Henry as a "malicious tyrant." He was barbarously murdered in the great cathedral at the foot of the altar of St. Benedict, on the 29th of December, 1170.

A'BECKETT, GILBERT ABBOTT, a successful cultivator of light literature, was born in London in 1811, and educated at Westminster School. He wrote burlesque dramas with success from his boyhood, took an active share in the establishment of different comic periodicals, particularly *Figaro in London* and *Punch*, and was a constant contributor to the columns of the latter from its commencement till his death in 1856.

ABEL (*breath, vanity, transitoriness*), the second son of Adam, slain by Cain, his elder brother.

ABEL, KARL FRIEDRICH (1726-1787), a celebrated German musician. His adagio compositions have been highly praised, but he attained greater distinction as a performer than as a composer, his instrument being the *Viola dagamba*, which from his time has given place to the violoncello.

ABEL, NIELS HENRIK, one of the ablest and acutest mathematicians of modern times, was born at Findøe, in Norway, in 1802, and died near Arendal, in 1829.

ABEL, SIR FREDERICK AUGUSTUS, was born in London, Eng., in 1827. He became a chemist and devoted his attention to the study of the higher explosives, on which he is one of the leading authorities. He made numerous discoveries with nitro-glycerine and gelatine. In 1883 he was knighted and was made D. C. L. of Oxford.

ABEL, THOMAS, a Roman Catholic divine during the reign of Henry VIII., was an Englishman, but when or where born does not appear. He had been introduced to the court through the report of his learning in classical and living languages, and accomplishments in music; and he was appointed domestic chaplain to Queen Catherine. As belonging to the Church of Rome, he inevitably opposed Henry VIII.'s assumption of supremacy in the church. Ultimately he was tried and condemned for "misprision of treason," and perished in the usual cruel and ignoble way.

ABELARD, PETER, born at Pallet (Palais), not far from Nantes, in 1079, was the eldest son of a noble Breton house. As a boy, he showed an extraordinary quickness of apprehension, and, choosing a learned life instead of the active career natural to a youth of his birth, early became an adept in the art of dialectic, under which name philosophy, meaning at that time chiefly the logic of Aristotle transmitted through Latin channels,

was the great subject of liberal study in the episcopal schools. His wanderings brought him to Paris, still under the age of twenty. There, in the great cathedral school of Notre-Dame, he sat for a while under the teaching of William of Champeaux, and the most advanced of Realists, but, presently stepping forward, he overcame the master in discussion, and thus began a long duel that issued in the downfall of the philosophic theory of Realism, till then dominant in the early Middle Age. First, in the teeth of opposition from the metropolitan teacher, he proceeded to set up a school of his own at Melun, whence, for more direct competition, he removed to Corbeil, near Paris. The success of his teaching was signal, though for a time he had to quit the field, the strain proving too great for his physical strength. On his return, after 1108, he found William lecturing no longer at Notre-Dame, but in a monastic retreat outside the city, and there battle was again joined between them. His discomfited rival still had power to keep him from lecturing in Paris, but soon failed in this last effort also. From Melun, where he had resumed teaching, Abelard passed to the capital, and set up his school on the heights of St. Genevieve, looking over Notre-Dame. He stepped into the chair at Notre-Dame, being also nominated canon, about the year 1115.

Few teachers ever held such sway as Abelard now did for a time. Distinguished in figure and manners, he was seen surrounded by crowds of students, drawn from all countries by the fame of his teaching; in which acuteness of thought was relieved by simplicity and grace of exposition. Enriched by the offerings of his pupils, and feasted with universal admiration, he came, as he says, to think himself the only philosopher standing in the world. But a change in his fortunes was at hand. In his devotion to science, he had hitherto lived a very regular life, varied only by the excitement of conflict: now, at the height of his fame, other passions began to stir within him. There lived at that time, within the precincts of Notre-Dame, under the care of her uncle, the canon Fulbert, a young girl named Heloise, of noble extraction and born about 1101. Fair, but still more remarkable for her knowledge, which extended beyond Latin, it is said, to Greek and Hebrew, she awoke a feeling of love in the breast of Abelard; and with intent to win her, he sought and gained a footing in Fulbert's house as a regular inmate. Becoming also tutor to the maiden, he used the unlimited power which he thus obtained over her for the purpose of seduction, though not without cherishing a real affection which she returned in unparalleled devotion. Their relation interfering with his public work, and being, moreover, ostentatiously sung by himself, soon became known to all the world except the too-confiding Fulbert; and, when at last it could not escape even his vision, they were separated only to meet in secret. Thereupon Heloise found herself pregnant, and was carried off by her lover to Brittany, where she gave birth to a son. To appease her furious uncle, Abelard now proposed a marriage, under the condition that it should be kept secret, in order not to mar his prospects of advancement in the church; but of marriage, whether public or secret, Heloise would hear nothing. She appealed to him not to sacrifice for her the independence of his life, nor did she finally yield to the arrangement without the darkest forebodings, only too soon to be realized. The secret of the marriage was not kept by Fulbert; and when Heloise, true to her singular purpose, boldly then denied it, life was made so unsupportable to her that she sought refuge in the convent of Argenteuil. Immediately Fulbert, believing that her husband, who aided in the flight, designed to be rid of her, conceived a dire revenge. He and some others broke into Abelard's

chamber by night, and, taking him defenceless, perpetrated on him the most brutal mutilation. Thus cast down from his pinnacle of greatness into an abyss of shame and misery, there was left to the brilliant master only the life of a monk. Heloise, not yet twenty, consummated her work of self-sacrifice at the call of his jealous love, and took the veil.

It was in the Abbey of St. Denis that Abelard, now aged forty, sought to bury himself with his woes out of sight. Finding, however, in the cloister neither calm nor solitude, and having gradually turned again to study, he yielded after a year to urgent entreaties from without and within, and went forth to reopen his school at the Priory of Maisoncelle (1120). The life in his own monastery proving no more congenial than formerly, he fled from it in secret, and only waited for permission to live away from St. Denis before he chose the one lot that suited his present mood. In a desert place near Nogent-sur-Seine, he built himself a cabin of stubble and reeds, and turned hermit. But there fortune came back to him with a new surprise. His retreat becoming known, students flocked from Paris, and covered the wilderness around him with their tents and huts. When he began to teach again, he found consolation, and in gratitude he consecrated the new oratory they built for him by the name of the Paraclete.

Upon the return of new dangers, or at least of fears, Abelard left the Paraclete to make trial of another refuge, accepting an invitation to preside over the Abbey of St. Gildas-de-Rhuys, on the far-off shore of Lower Brittany. It proved a wretched exchange. The region was inhospitable, the domain a prey to lawless exaction, the house itself savage and disorderly. Yet for nearly ten years he continued to struggle with fate before he fled from his charge, yielding in the end only under peril of violent death. As far back as the Paraclete days, he had counted as chief among his foes Bernard of Clairvaux, in whom was incarnated the principle of fervent and unhesitating faith, from which rational inquiry like his was sheer revolt, and now this uncompromising spirit was moving, at the instance of others, to crush the growing evil in the person of the boldest offender. After preliminary negotiations, in which Bernard was roused by Abelard's steadfastness to put forth all his strength, a council met at Sens, before which Abelard, formally arraigned upon a number of heretical charges, was prepared to plead his cause. When, however, Bernard had opened the case, suddenly Abelard appealed to Rome. The stroke availed him nothing; for Bernard, who had power, notwithstanding, to get a condemnation passed at the council, did not rest a moment till a second condemnation was procured at Rome in the following year. Meanwhile, on his way thither to urge his plea in person, Abelard had broken down at the Abbey of Cluni, and there, an utterly fallen man, with spirit of the humblest, and only not bereft of his intellectual force, he lingered but a few months before the approach of death. Removed by friendly hands, for the relief of his sufferings, to the Priory of St. Marcel, he died on the 21st of April, 1142.

The general importance of Abelard lies in his having fixed more decisively than any one before him the scholastic manner of philosophising, with its object of giving a formally rational expression to the received ecclesiastical doctrine. Through him was prepared in the Middle Age the ascendancy of the philosophical authority of Aristotle, which became firmly established in the half-century after his death, when first the completed *Organon*, and gradually all the other works of the Greek thinker, came to be known in the schools: before his time it was rather upon the authority of Plato that the prevailing Realism sought to lean.

ABENCERRAGES, a family or faction that is said to have held a prominent position in the Moorish kingdom of Granada in the 15th century. The hall of the Abencerrages in the Alhambra takes its name from being the reputed scene of the massacre of the family.

ABENEZRA, or **IBN EZRA**, is the name ordinarily given to **ABRAHAM BEN MEIR BEN EZRA** (called also *Abenare* or *Evenare*), one of the most eminent of the Jewish literati of the Middle Ages. He was born at Toledo about 1090; left Spain for Rome about 1140; resided afterward at Mantua (1145), at Lucca (1154), at Rhodes (1155 and 1166), and in England (1159); and died probably in 1168. He was distinguished as a philosopher, astronomer, physician, and poet, but especially as a grammarian and commentator.

ABENSBURG, a small town of Bavaria, 18 miles S. W. of Regensburg, containing 1300 inhabitants.

ABERAVON, a parliamentary and municipal borough of WALES, in the county of Glamorgan, beautifully situated on the Avon, near its mouth, 8 miles east of Swansea.

ABERCONWAY. See **CONWAY**.

ABERCROMBIE, **JOHN**, an eminent physician of Edinburgh, was the son of the Rev. George Abercrombie of Aberdeen, in which city he was born in 1781. After attending the Grammar School and Marischal College, Aberdeen, he commenced his medical studies at Edinburgh in 1800, and obtained his degree of M.D. there in 1803. Soon afterward he went to London, and for about a year gave diligent attention to the medical practice and lectures in St. George's Hospital. In 1823, he became a Licentiate of the College of Physicians; in 1824, a Fellow of that body; and from the death of Dr. Gregory in 1822, he was considered the first physician in Scotland. He died in 1844.

ABERCROMBY, **DAVID**, M.D. This Scottish physician was sufficiently noteworthy half a century after his (probable) decease to have his *Nova Medicina Praxis* reprinted at Paris in 1740. Of this early metaphysician nothing biographical has, however, come down, save that he was a Scotchman ("Scotus")—born at Seaton. He was living early in the 18th century.

ABERCROMBY, **JAMES**, **LORD DUNFERMLINE**, third son of the celebrated Sir Ralph Abercromby, was born on the 7th Nov. 1776. Educated for the profession of the law, he was called to the bar at Lincoln's Inn in 1801, but he was prevented from engaging to any considerable extent in general practice by accepting appointments, first as commissioner in bankruptcy, and subsequently, as steward of the estates of the Duke of Devonshire. He commenced his political career in 1807, when he was elected member of Parliament for the borough of Midhurst. His sympathies with the small and struggling Opposition had already been declared, and he at once attached himself to the Whig party, with which he consistently acted throughout life. In 1834 Mr. Abercromby obtained a seat in the cabinet of Lord Grey as Master of the Mint. In 1839 he resigned the office, and received the customary honor of a peerage, with the title of Lord Dunfermline. The evening of his life was passed in retirement at Colinton, near Edinburgh, where he died on the 17th April 1858.

ABERCROMBY, **PATRICK**, M.D., was the third son of Alexander Abercromby of Fetterneir in Aberdeenshire, and brother of Francis Abercromby, who was created by James II. Lord Glasford. He was born at Forfar in 1656. As throughout Scotland, he could have had there the benefits of a good parish school; but it would seem from after events that his family was Roman Catholic, and hence, in all probability, his education was private. This, and not the unproved charge of perversion from Protestantism in subserviency to James II., explains his

Roman Catholicism and adhesion to the fortunes of that king. But, intending to become a doctor of medicine, he entered the University of St. Andrews, where he took his degree of M.D. in 1685. The work with which Abercromby's name is permanently associated is his *Marital Achievements of the Scots Nation*, issued in two noble folios, vol. i. 1711, vol. ii. 1716. The date of his death is uncertain. It has been variously assigned to 1715, 1716, 1720 and 1726, and it is usually added that he left a widow in great poverty. That he lived in 1716 is certain, as Crawford speaks of him (in his *Peerage*, 1716) "as my worthy friend." Probably he died about 1716.

ABERCROMBY, **SIR RALPH**, K.B., Lieutenant-General in the British army, was the eldest son of George Abercromby of Tullibody, Clackmannanshire, and was born in October, 1734. After passing some time at an excellent school at Alloa, he went to Rugby, and in 1752-53 he attended classes in Edinburgh University. In 1754 he was sent to Leipsic to study civil law, with a view to his proceeding to the Scotch bar, of which it is worthy of notice that both his grandfather and his father lived to be the oldest members. On returning from the Continent he expressed a strong preference for the military profession, and a cornet's commission was accordingly obtained for him (March 1756) in the 3d Dragoon Guards. He rose through the intermediate gradations to the rank of lieutenant-colonel of the regiment (1773), and in 1781 he became colonel of the 103d infantry. When that regiment was disbanded in 1783 he retired upon half-pay. That up to this time he had scarcely been engaged in active service, was owing mainly to his disapproval of the policy of the Government, and especially to his sympathies with the American colonists in their struggles for independence; and his retirement is no doubt to be ascribed to similar feelings. But on France declaring war against England in 1793, he hastened to resume his professional duties; and, being esteemed one of the ablest and most intrepid officers in the whole British forces, he was appointed to the command of a brigade under the Duke of York, for service in Holland. He commanded the advance guard in the action on the heights of Cateau, and was wounded at Nimeguen. The duty fell to him of protecting the British army in its disastrous retreat out of Holland, in the winter of 1794-95. In 1795 he received the honor of knighthood, the Order of the Bath being conferred on him in acknowledgment of his services. At the battle in the neighborhood of Alexandria (March 21, 1801), Sir R. Abercromby was struck by a spent ball, which could not be extracted, and died seven days after.

ABERDARE, a town of Wales, in the county of Glamorgan, on the right bank of the river Cynon, four miles S.W. of Merthyr-Tydvil. The district around is rich in valuable mineral products, and coal and iron mining are very extensively carried on in the neighborhood. Important tin-works, too, have been recently opened. Part of the coal is used at the iron-works, and large quantities are sent to Cardiff.

ABERDEEN, a royal burgh and city, the chief part of a parliamentary burgh, the capital of the county of Aberdeen, the chief seaport in the north of Scotland, and the fourth Scottish town in population, industry, and wealth. It lies on the German Ocean, near the mouth of the river Dee, and is 542 miles north of London, and 111 miles north of Edinburgh, by the shortest railway routes.

Aberdeen, probably the Devana on the Diva of Ptolemy, was an important place in the 12th century. William the Lion had a residence in the city, to which he gave a charter in 1179, confirming the corporate rights granted by David I. The city received many subsequent

royal charters. It was burned by Edward III. in 1336, but it was soon rebuilt and extended, and called New Aberdeen. The houses were of timber and thatched, and many such existed till 1741. The burgh records are the oldest of any Scotch burgh. They begin in 1398, and are complete to the present time, with only a short break. Extracts from them, extending from 1398 to 1570, have been published by the Spalding Club. For many centuries the city was subject to attacks by the barons of the surrounding districts, and its avenues and six ports had to be guarded. The ports had all been removed by 1770. Several monasteries existed in Aberdeen before the Reformation. Most of the Scottish sovereigns visited the city and received gifts from the authorities. In 1497 a blockhouse was built at the harbor mouth as a protection against the English. During the religious struggle in the 17th century between the Royalists and Covenanters the city was plundered by both parties. In 1715 Earl Marischal proclaimed the Pretender at Aberdeen. In 1745 the Duke of Cumberland resided a short time in the city. In the middle of the 18th century boys were kidnapped in Aberdeen, and sent as slaves to America. In 1817 the city became insolvent, with a debt of £225,710, contracted by public improvements, but the debt was soon paid off. The motto on the city arms is Bon-Accord. It formed the watchword of the Aberdonians while aiding King Robert the Bruce in his battles with the English.

Till 1800 the city stood on a few eminences, and had steep, narrow, and crooked streets, but, since the Improvement Act of that year, the whole aspect of the place has been altered by the formation of two new spacious and nearly level streets (Union Street and King Street, meeting in Castle Street), and by subsequent laying out of many others, besides squares, terraces, &c., on nearly flat ground. The city is above eight miles in circuit, and is built on sand, gravel and boulder clay.

Aberdeen is now a capacious, elegant, and well-built town, and from the material employed, consisting chiefly of light grey native granite, is called the "granite city." It contains many fine public buildings.

The University of Aberdeen was formed by the union and incorporation, in 1860, by Act of Parliament, of the University and King's College of Aberdeen, founded in Old Aberdeen, in 1494, by William Elphinstone, Bishop of Aberdeen, under the authority of a Papal bull obtained by James IV., and of the Marischal College and University of Aberdeen, founded in New Aberdeen, in 1593, by George Keith, Earl Marischal, by a charter ratified by Act of Parliament.

Aberdeen has about 60 places of worship, with nearly 48,000 sittings. There are 10 Established churches; 20 Free, 6 Episcopalian, 6 United Presbyterian, 5 Congregational, 2 Baptist, 2 Methodist, 2 Evangelical Union, 1 Unitarian, 1 of Roman Catholic, 1 of Friends, and 1 of Original Seceders. There are also several mission chapels. In 1843 all the Established ministers seceded, with 10,000 lay members. The Established and Free Church denominations have each about 11,000 members in communion. The Established West and East churches, in the centre of the city, within St. Nicholas churchyard, form a continuous building 220 feet long, including an intervening aisle, over which is a tower and spire 140 feet high.

The Dee to the south of the city is crossed by three bridges—the old bridge of Dee, an iron suspension bridge, and the Caledonian Railway bridge. The first, till 1832 the only access to the city from the south, consists of seven semicircular ribbed arches, is about 30 feet high, and was built early in the 16th century by Bishops Elphinstone and Dunbar.

A defective harbor and a shallow sand and gravel bar at its entrance, long retarded the trade of Aberdeen,

but, under various acts since 1773, they have been greatly deepened. The navigation channel is being widened and deepened, and the old pier or breakwater on the north side of the river mouth is to be lengthened at least 500 feet seaward. A body of 31 commissioners manage the harbor affairs.

Aberdeen Bay affords safe anchorage with off-shore winds, but not with those from the N.E., E. and S.E.

The manufactures, arts, and trade of Aberdeen and vicinity are large and flourishing. Woollens were made as early as 1703, and knitting of stockings was a great industry in the 18th century. There are two large firms in the woollen trade, with 1550 hands, at £1000 weekly wages, and making above 1560 tons wool in the year into yarns, carpets, hand-knit hosiery, cloths, and tweeds. The linen trade, much carried on since 1749, is now confined to one firm, with 2600 hands, at £1200 wages weekly, who spin, weave, and bleach 50 tons flax and 60 tons tow weekly, and produce yarns, floorcloths, sheeting, dowlas, ducks, towels, sail canvas, &c. The cotton manufacture, introduced in 1779, employs only one firm, with 550 hands, at £220 weekly wages, who spin 5000 bales of cotton a-year into mule yarn. The wincey trade, begun in 1839, employs 400 hands, at £200 weekly wages, who make 2,100,000 yards cloth, 27 to 36 inches broad, in the year. Paper, first made here in 1696, is now manufactured by three firms in the vicinity. The largest has 2000 hands, at £1250 weekly wages, and makes weekly 75 to 80 tons of writing paper, and 6½ millions of envelopes, besides much cardboard and stamped paper; another firm makes weekly 77 tons coarse and card paper; and a third, 20 tons printing and other paper. The comb works of Messrs. Stewart & Co., begun in 1827, are the largest in the world, employing 900 hands, at £500 weekly wages, who yearly convert 1100 tons horn, hoofs, india-rubber, and tortoise-shells into 11 millions of combs, besides spoons, cups, scoops, paper-knives, &c. Seven iron foundries and many engineering works employ 1000 men, at £925 weekly wages, and convert 6000 tons of iron a-year into marine and land steam engines and boilers, corn mills, wood-preparing machinery, machinery to grind and prepare artificial manures, besides sugar mills and frames and coffee machinery for the colonies.

Very durable grey granite has been quarried near Aberdeen for 300 years, and blocked and dressed paving, curb and building granite stones have long been exported from the district. In 1764, Aberdeen granite pavement was first used in London. About the year 1795, large granite blocks were sent for the Portsmouth docks. The chief stones of the New Thames Embankment, London, are from Kemnay granite quarries, 16 miles northwest of the city. Aberdeen is almost entirely built of granite, and large quantities of the stone are exported to build bridges, wharfs, docks, lighthouses, &c., elsewhere. Aberdeen is famed for its polishing works of granite, especially grey and red. They employ about 1500 hands in polishing vases, tables, chimney-pieces, fountains, monuments, columns, &c., for British and foreign demand.

Aberdeen has been famed for shipbuilding, especially for its fast clippers. Since 1855 nearly a score of vessels have been built of above 1000 tons each. The largest vessel (a sailing one) ever built here was one in 1855, of 2400 tons.

The introduction of steamers in 1821 greatly promoted industry and traffic, and especially the cattle trade of Aberdeenshire with London. These benefits have been much increased by the extension of railways. Commodious steamers ply regularly between Aberdeen and London, Hull, Newcastle, Leith, Wick, Kirkwall and Lerwick.

The joint railway station for the Caledonian, Great North of Scotland, and Deeside lines, was opened 1867, and is a very handsome erection, costing about £26,000. It is 500 feet long, and 102 feet broad, with the side walls 32 feet high. The arched roof of curved lattice-iron ribs, covered with slate, zinc, and glass, is all in one span, rising 72 feet high, and is very light and airy.

The city is governed by a corporation, the magistrates and town council, consisting of twenty-five councillors, including a provost, six bailies, a dean of guild, a treasurer, etc. The corporation revenue in the year 1871-72, was £11,498. The police, water, and gas are managed by the council. The municipal and police burgh has an area of nearly three square miles, with 12,514 municipal electors, and with assessable property valued at £230,000 in 1873. The Parliamentary burgh has an area of nine square miles, including Old Aberdeen and Woodside, with 14,253 Parliamentary electors, and real property to the value of £309,328 in 1873. It returns one member to Parliament. The population of Aberdeen in 1396 was about 3,000; in 1643, 8,750; in 1708, 5,556; in 1801, 26,992; in 1841, 63,262; and in 1871, 88,125; in the next decade it increased largely; in 1901 its population was 143,722.

ABERDEEN, OLD, is a small, quiet, ancient town, a burgh of barony and regality, a mile north of Aberdeen, and as far southwest of the mouth of the Don.

The town was formerly the see of a bishop, and had a large cathedral dedicated to St. Machar. In 1137 David I. translated to Old Aberdeen the bishopric, founded at Mortlach in Banffshire in 1004 by Malcolm II. in memory of his signal victory there over the Danes. In 1153 Malcolm IV. gave the bishop a new charter.

ABERDEEN, situated in Brown county, S. Dak., is a prominent trade and railway center, and one of the most prosperous and thriving municipalities in the State. It is on the Chicago, Milwaukee and St. Paul, Chicago and North-Western, and Great Northern railroads, 588 miles from Chicago, and 290 miles from St. Paul, and is the shipping point for a large agricultural country. The city has several daily and weekly papers, manufactures of agricultural implements, lumber, carriages, sash, doors and blinds, etc., and does a large jobbing trade. It is also the location of a United States land office, and is well provided with schools, churches, etc. Population in 1900 was 4,087.

ABERDEEN, the capital of Monroe county, Miss., is situated at the head of navigation on the Tombigbee river, being also located on the Illinois Central, Mobile and Ohio, and Canton, Aberdeen and Nashville railroads. The river at this point is crossed by a substantial iron bridge. The city contains several banks, weekly papers, a court-house, the State military institute, two female colleges, and manufactures of a general character. Population (1900), 3,433.

ABERDEENSHIRE, a maritime county in the northeast of Scotland. It is bounded on the north and east by the German Ocean; on the south by the counties of Kincardine, Forfar, and Perth; and on the west by those of Inverness and Banff. Its greatest length is 102 miles, and breadth 50 miles. Its circuit with sinuosities is about 300 miles, 60 being sea-coast. It is the third of Scotch counties in size, and is one-sixteenth of the extent of Scotland. Population (1901), 304,420.

The chief rivers are the Dee, 96 miles long; Don, 78; Ythan, 37, with mussel beds at its mouth; Ugie, 20; and Deveron, 58, partly on the boundary of Banffshire.

The climate of Aberdeenshire, except in the mountainous districts, is comparatively mild.

The rocks are mostly granite, gneiss, with small tracts

of syenite, mica slate, quartz rock, clay slate, grauwacke, primary limestone, old red sandstone, serpentine, and trap. Lias, greensand, and chalk flints occur.

The tops of the highest mountains have an arctic flora. Trees, especially Scotch fir and larch, grow well in the country, and Braemar abounds in natural timber, said to surpass any in the north of Europe. Stumps of Scotch fir and oak found in peat in the county are often far larger than any now growing. Grouse, partridges, and hares abound in the county, and rabbits are often too numerous. Red deer abound in Braemar, the deer forest being there valued at £5,000 a year, and estimated at 500,000 acres, or one-fourth the area of deer forests in Scotland.

Poor, gravelly, clayey, and peaty soils prevail much more in Aberdeenshire than good, rich loams, but tile draining, bones and guano, and the best modes of modern tillage, have greatly increased the produce. Farm-houses and steadings have greatly improved, and the best agricultural implements and machines are in general use. About two-thirds of the population depend entirely on agriculture, and oatmeal in various forms, with milk, is the chief food of farm-servants. Farms are generally small, compared with those in the south-east counties. The fields are separated by dry-stone dykes, and also by wooden and wire fences.

The great mineral wealth in Aberdeenshire is its long-famed durable granite, which is largely quarried for building, paving, causewaying and polishing.

A large fishing population in villages along the coast engage in the white and herring fishery. Haddock are salted and rock-dried (speldings), or smoked (finnans). The rivers and coast yield many salmon. Peterhead was long the chief British port for the north whale and seal fishery, but Dundee now vies with it in this industry.

The manufactures and arts of the county are mainly prosecuted in or near the town of Aberdeen, but throughout the rural districts there are much milling of corn, brick and tile making, stone-quarrying, smith-work, brewing and distilling, cart and farm implement making, casting and drying of peat, timber felling, especially on Deeside and Donside, for pit-props, railway sleepers, lath, barrel staves, etc.

Aberdeenshire communicates with the south by the Caledonian railway, and five macadamised roads across the east Grampians, the highest rising 2,200 feet above the sea.

The chief antiquities in Aberdeenshire are Picts' houses or weems; stone foundations or circular dwellings; monoliths, some being sculptured; the so-called Druid circles; stone cists; stone and earthen enclosures; the vitrified forts of Dunnideer and Noath; cairns; crannoges; earthen mounds, as the Bass; flint arrow-heads; clay funeral urns; stone celts and hammers. Remains of Roman camps occur at Peterculter, Kintore, and Auchterless, respectively 107½, 100, and 115 acres. Roman arms have been found. Ruins of ancient edifices occur. On the top of a conical hill called Dunnideer, in the Garioch district, are the remains of a castle, supposed to be 700 years old, and surrounded by a vitrified wall, which must be still older. The foundations of two buildings still remain, the one in Braemar, and the other in the Loch of Cannor (the latter with the remains of a wooden bridge between it and the land), which are supposed to have belonged to Malcolm Canmore, King of Scotland. The most extensive ruins are the grand ones of Kildrummy Castle, evidently once a princely seat, and still covering nearly an acre of ground. It belonged to David, Earl of Huntingdon, in 1150, and was the seat of the Earls of Marr, attainted in 1716. The Abbey of Deer, now in ruins, was begun by Cumyn, Earl of Buchan, about 1219.

In Roman times, Aberdeenshire formed part of Vespasiana in Caledonia, and was occupied by the Taixali, a warlike tribe. The local names are mostly Gaelic. St. Columba and his pupil, Drostan, visited Buchan in the 6th century. In 1052 Macbeth fell near the Peel Bog in Lumphanen, and a cairn which marks the spot is still shown. In 1309 Bruce defeated Comyn, Earl of Buchan, near Inverurie, and annihilated a powerful Norman family. In 1411 the Earl of Marr defeated Donald of the Isles in the battle of Harlaw, near Inverurie, when Sir Robert Davidson, Provost of Aberdeen, was killed. In 1562 occurred the battle of Corrichie on the Hill of Fare, when the Earl of Murray defeated the Marquis of Huntly. In 1715 the Earl of Marr proclaimed the Pretender in Braemar. In 1746 the Duke of Cumberland with his army marched through Aberdeenshire to Culloden. In 1817 a base line of verification, 5 miles 100 feet long, was measured in connection with the Trigonometrical Survey of the British Isles, on the Belhelvie Links, 5 to 10 miles north of Aberdeen.

Aberdeenshire contains 105 Established churches, 99 Free, 31 Episcopal, 15 United Presbyterian, 9 Roman Catholic, and 31 of other denominations. This includes detached parts of the two adjacent counties.

Aberdeenshire has one city, Aberdeen, a royal parliamentary burgh; three other royal parliamentary burghs, Inverurie, Kintore, and Peterhead; and seven burghs of barony, Old Aberdeen, Charleston of Aboyne, Fraserburgh, Huntly, Old Meldrum, Rosehearty, and Turriff.

The county sends two members to Parliament—one for East Aberdeenshire, with 11,543 electors, and the other for West Aberdeenshire, with 9,830 electors.

ABERDEEN, GEORGE HAMILTON GORDON, FOURTH EARL OF, was born at Edinburgh on the 28th January 1784. He was educated at Harrow School, and at St. John's College, Cambridge, where he graduated in 1804. He succeeded his grandfather in the earldom in 1801, and in the same year he made an extended tour through Europe, visiting France, Italy, and Greece. On his return he founded the Athenian Club, the membership of which was confined to those who had travelled in Greece. In 1806, having been elected one of the representative peers for Scotland, he took his seat in the House of Lords on the Tory side. Lord Aberdeen was a member of the Cabinet formed by the Duke of Wellington in 1828, for a short time as Chancellor of the Duchy of Lancaster, and then as Foreign Secretary. He was Colonial Secretary in the Tory Cabinet of 1834–5, and again received the seals of the Foreign Office under Sir Robert Peel's administration of 1841. The policy of non-intervention, to which he steadfastly adhered in his conduct of foreign affairs, was at once his strength and his weakness. On the two chief questions of home politics which were finally settled during his tenure of office, he was in advance of most of his party. While the other members of the Government yielded Catholic Emancipation and the repeal of the Corn Laws as unavoidable concessions, Lord Aberdeen spoke and voted for both measures from conviction of their justice. He had been regarded as the leader of the Peel party from the time of Sir Robert's death, but his views on the two great questions of home policy above mentioned rendered him more acceptable to the Liberals, and a more suitable leader of a coalition government than any other member of that party could have been. His administration will chiefly be remembered in connection with the Crimean war, which, it is now generally believed, might have been altogether prevented by a more vigorous policy. He died December 13, 1860.

ABERDOUR, a village in the county of Fife, in Scotland, pleasantly situated on the north shore of the Firth of Forth, and much resorted to for sea-bathing.

ABERFELDY, a village in Perthshire, celebrated in Scottish song for its "birks" and for the neighboring falls of Moness.

ABERGAVERNNEY, a market town in Monmouthshire, 14 miles west of Monmouth, situated at the junction of a small stream called the Gavenney, with the river Usk.

ABERNETHY, a town in Perthshire, situated in the parish of the same name, on the right bank of the Tay, 7 miles below Perth.

ABERNETHY, JOHN,—a Protestant dissenting divine of Ireland, was born at Coleraine, county Londonderry, Ulster, where his father was minister (Nonconformist), on the 19th October 1680. In his thirteenth year he entered a student at the University of Glasgow. On concluding his course at Glasgow he went to Edinburgh University, where his many brilliant gifts and quick and ready wit—thought-born, not verbal merely—struck the most eminent of his contemporaries and even his professors. In 1701 he was urgently invited to accept the ministerial charge of an important congregation in Antrim; and, after an interval of two years, he was ordained there on 8th August 1703. In 1717 he was invited to the congregation of Usher's Quay, Dublin, as colleague with Rev. Mr Arbuckle, and contemporaneously, to what was called the Old Congregation of Belfast. He was nearly a century in advance of his time. He had to reason with those who denied that a Roman Catholic or Dissenter could be a "man of integrity and ability." He died in 1740, having been twice married.

ABERNETHY, JOHN, grandson of the preceding, an eminent surgeon, was born in London on the 3d of April, 1764. His father was a London merchant. Educated at Wolverhampton Grammar School, he was apprenticed in 1779 to Sir Charles Blicke, a surgeon in extensive practice in the metropolis. He attended Sir William Blizard's anatomical lectures at the London Hospital, and was early employed to assist Sir William as "demonstrator;" he also attended Pott's surgical lectures at St. Bartholomew's Hospital, as well as the lectures of the celebrated John Hunter. On Pott's resignation of the office of surgeon of St. Bartholomew's, Sir Charles Blicke, who was assistant-surgeon, succeeded him, and Abernethy was elected assistant-surgeon in 1787. In this capacity he began to give lectures in Bartholomew Close, which were so well attended that the governors of the hospital built a regular theatre (1790–91), and Abernethy thus became the founder of the distinguished School of St. Bartholomew's. The celebrity Abernethy attained in his practice was due not only to his great professional skill, but also in part to the singularity of his manners. He used great plainness of speech in his intercourse with his patients, treating them often brusquely, and sometimes even rudely. In the circle of his family and friends he was courteous and affectionate; and in all his dealings he was strictly just and honorable. He resigned his surgery at St. Bartholomew's Hospital in 1827, and his professorship at the College of Surgeons two years later, on account of failing health, and died at his residence at Enfield on the 20th of April, 1831.

ABERRATION, or (more correctly) THE ABERRATION OF LIGHT, is a remarkable phenomenon, by which stars appear to deviate a little, in the course of a year, from their true places in the heavens. It results from the eye of the observer being carried onwards by the motion of the earth on its orbit, during the time that light takes to travel from the star to the earth.

Aberration always takes place in the direction of the earth's motion; that is, it causes the stars to appear nearer than they really are to the point towards which the earth is at the moment moving. That point is necessarily on the ecliptic, and 90° in advance of the earth in longitude.

ABERYSTWITH, a municipal and parliamentary borough, market town, and seaport of Wales, in the county of Cardigan, is situated at the western end of the Vale of Rheidol, near the confluence of the rivers Ystwith and Rheidol, and about the center of Cardigan Bay. It is the seat of a college in Wales.

ABETTOR, a law term implying one who instigates, encourages, or assists another to perform some criminal action. See **ACCESSORY**.

ABEYANCE, a law term denoting the expectancy of an estate. Thus, if lands be leased to one person for life, with reversion to another for years, the remainder for years is in abeyance till the death of the lessee.

ABGAR, the name or title of a line of kings of Edessa, in Mesopotamia. One of them is known from a correspondence he is said to have had with Jesus Christ.

ABIAD, **BAHR-EL**, a name given to the western branch of the Nile, above Khartoum. It is better known as the White Nile. See **NILE**.

ABICH, **WILHELM HERMANN**, born at Berlin, Prussia, December 11, 1806; died July 2, 1886. He studied at Berlin; was professor at Dorpat, and fellow of St. Petersburg Academy, and explored Armenia, the Caucasus, and Northern Persia, about the geology and meteorology of which he wrote a number of volumes. From 1877 he resided at Vienna, where he was held in high repute.

ABIES. See **FIR**.

ABILA, a city of ancient Syria, the capital of the tetrarchy of Abilene, a territory whose limit and extent it is impossible now to define.

ABILDGAARD, **NIKOLAJ**, called "the Father of Danish Painting," was born in 1744. He formed his style on that of Claude and of Nicolas Poussin, and was a cold theorist. He died in 1809.

ABILENE, a city of Kansas, the capital of Dickinson county, is situated on the Kansas, or Kaw, river, at a point ninety-five miles west of Topeka, the State capital. It has extensive railroad connections, and is an important cattle-trading center, large shipments of cattle in all directions being made here. It has good banking facilities and telegraph connections. The town contains many churches and an opera house, and its educational facilities are ample. It has several newspapers. This town is one of the outlying distributing points which have had such an effect in the upbuilding of both Kansas City and St. Joseph. Pop. (1900), 3,507.

ABIMELECH (*father of the king*, or rather, perhaps, *king-father*), occurs first in the Bible as the name of certain kings of the Philistines, and is supposed to be their official title.

ABINGDON, a parliamentary and municipal borough and market town of England, in Berkshire, on a branch of the Thames, 7 miles south of Oxford, and 51 miles W.N.W. of London.

ABINGDON, in Washington county, Virginia, noteworthy as a tobacco market and the seat of a female college, and also as the scene of some important operations of the late Civil war (1861-65). Population (1900), 1,306.

ABIOGENESIS, as a name for the production of living by non-living matter, has of late been superseding the less accurate phrase "Spontaneous Generation." Professor Huxley, who made use of the word in his presidential address to the British Association in 1870, distinguished Abiogenesis from "Xenogenesis" or "Heterogenesis," which occurs, or is supposed to occur, not when dead matter produces living matter, but when a living parent gives rise to offspring which passes through a totally different series of states from those exhibited by the parent, and does not return into the parent's cycle of changes. When a "living parent

gives rise to offspring which passes through the same cycle of changes as itself," there occurs "Homogenesis." "Biogenesis" includes both of these. The question of Abiogenesis—whether under certain conditions living matter is produced by not-living matter—as it is one of the most fundamental, is perhaps also the oldest in Biology; but within recent years—partly because the means of accurate experimentation have been increased and the microscope improved, and partly because the question has been recognized in its important bearings on evolution, the correlation of forces, and the theory of infectious diseases—naturalists have been led to bestow more attention upon it than at any previous period.

The defenders of Abiogenesis, on the other hand, while interpreting the results of past observation and experiment in their own favor, are yet less disposed to rest on these, rather preferring to argue from those wide analogies of evolution and correlation which seem to support their doctrine. The fullest discussion of the subject of Abiogenesis, from the Abiogenist's point of view, is to be found in Dr. Bastian's *Beginnings of Life*.

ABIPONES, a tribe of South American Indians, inhabiting the territory lying between Santa Fé and St. Iago. They originally occupied the Chaco district of Paraguay, but were driven thence by the hostility of the Spaniards.

ABJURATION. See **ALLEGIANCE**, page 206.

ABKHASIA, or **ABASIA**, a tract of Asiatic Russia, on the border of the Black Sea. The high mountains of the Caucasus on the N. and N.E. divide it from Circassia; on the S.E. it is bounded by Mingrelia; and on the S.W. by the Black Sea. Though the country is generally mountainous, there are some deep, well-watered valleys, and the climate is mild. The population of Abkhazia is variously stated at from 50,000 to 250,000.

ABLUTION, a ceremonial of purification, practiced in nearly every age and nation. It consisted in washing the body in whole or part, so as to cleanse it symbolically from defilement, and to prepare it for religious observances. Various forms of ablation practised by different nations are mentioned in the sixth book of the *Æneid*, and we are told that *Æneas* washed his ensanguined hands after the battle before touching his Penates. Symbolic ablation finds a place under the New Testament dispensation in the rite of baptism, which is observed, though with some variety of form and circumstances, throughout the whole Christian Church. By Roman Catholics and Ritualists, the term ablation is applied to the cleansing of the chalice and the fingers of the celebrating priest after the administration of the Lord's Supper.

ABNER (*father of light*), first cousin of Saul and commander-in-chief of his army. The chief references to him during the lifetime of Saul are found in 1 Sam. xvii. 55, and xxvi. 5.

ABO, a city and seaport, and chief town of the district of the same name in the Russian province of Finland, is situated in N. lat. 60° 26', E. long. 22° 19', on the Aurajoki, about 3 miles from where it falls into the Gulf of Bothnia.

ABOLITIONIST. See **SLAVERY**.

ABOMASUM, *caillette*, the fourth or rennet stomach of Ruminantia. From the *omasum* the food is finally deposited in the abomasum, a cavity considerably larger than either the second or third stomach, although less than the first.

ABOMEY, the capital of Dahomey, in West Africa, is situated in N. lat. 7° E. long. 2° 4', about 60 miles N. of Whydah, the port of the kingdom. It is a clay-built town, surrounded by a moat and mud walls, and

occupies a large area, part of which is cultivated. Population, (1897), 15,000. See DAHOMEY.

ABORIGINES, originally a proper name given to an Italian people who inhabited the ancient Latium, or country now called *Campagna di Roma*. Various derivations of this name have been suggested; but there can be scarcely any doubt that the usual derivation (*ab origine*) is correct, and that the word simply indicated a settled tribe, whose origin and earlier history were unknown. In modern times the term *Aborigines* has been extended in signification, and is used to indicate the inhabitants found in a country at its first discovery, in contradistinction to colonies or new races, the time of whose introduction into the country is known.

ABORTION, in *Midwifery* (from *aborior*, I perish), the premature separation and expulsion of the contents of the pregnant uterus. When occurring before the seventh lunar month of gestation, *abortion* is the term ordinarily employed, but subsequent to this period it is designated *premature labor*. The present notice includes both these terms. As an accident of pregnancy, abortion is far from uncommon, although its relative frequency, as compared with that of completed gestation, has been very differently estimated by accoucheurs. It is more liable to occur in the earlier than in the later months of pregnancy, and it would also appear to occur more readily at the periods corresponding to those of the menstrual discharge. Abortion may be induced by numerous causes, both of a local and general nature. Malformation of the pelvis, accidental injuries, and the diseases and displacements to which the uterus is liable, on the one hand; and, on the other, various morbid conditions of the ovum or placenta leading to the death of the foetus, are among the direct local causes of abortion. The tendency, however, to the recurrence of abortion in persons who have previously miscarried is well known, and should ever be borne in mind with the view of avoiding any cause likely to lead to a repetition of the accident.

ABOUKIR, a small village on the coast of Egypt, 13 miles N.E. of Alexandria, containing a castle which was used as a state prison by Mehemet Ali.

ABOUT, EDMOND FRANCOIS, born in Lorraine, February 14, 1828; died January 17, 1885. He early became known as a novelist and art critic, wrote several plays and some political pamphlets, the latter in the interest of Napoleonism. He was elected to the French Academy in 1884, but died before the formal reception could be had.

ABRABANEL, ISAAC, a celebrated Jewish statesman, philosopher, theologian, and commentator, was born at Lisbon in 1437. He belonged to an ancient family that claimed descent from the royal house of David, and his parents gave him an education becoming so renowned a lineage. He held a high place in the favor of King Alphonso V., who intrusted him with the management of important state affairs.

ABRACADABRA, a meaningless word once supposed to have a magical efficacy as an antidote against agues and other fevers. Ridiculously minute directions for the proper use of the charm are given in the *Præcepta de Medicina* of Serenus Sammonicus.

ABRAHAM or **ABRAM**, father of the Israelite race, was the first-born son of Terah, a Shemite, who left Ur of the Chaldees, in the north-east of Mesopotamia, along with Abram, Sarai, and Lot, and turned westwards in the direction of Canaan. Abram had married his half-sister, Sarai, who was ten years younger than himself; and though such relationship was afterwards forbidden by the law, it was common in ancient times, both among other peoples, and among the Hebrews themselves, at least before Moses. The cause of Terah's removing from his native country is not given. Having come to

Haran, he abode there till his death, at the age of 205. According to Genesis xii., Abram left Haran when he was 75 years of age, that is, before the death of his father, in consequence of a divine command, to which was annexed a gracious promise, "And I will make of thee a great nation, and I will bless thee, and make thy name great; and thou shalt be a blessing. And I will bless them that bless thee, and curse him that curseth thee; and in thee shall all families of the earth be blessed." How long the patriarch remained in Egypt is not related; nor are the influences which the religion, science, and learning of that civilized land had upon him alluded to. That they acted beneficially upon his mind, enlightening and enlarging it, can scarcely be doubted. His religious conceptions were transformed. The manifold wisdom of Egypt impressed him. Intercourse with men far advanced in civilization taught him much. Later tradition speaks of his communicating to the Egyptians the sciences of arithmetic and astronomy (Josephus i. 7); but this is founded upon the notion entertained at the time of the civilized Chaldeans of Babylon, whereas Ur of the Chaldees was a district remote from the subsequent centre of recondite knowledge. Abram received more than he imparted, for the Egyptians were doubtless his superiors in science. He found the rite of circumcision in use. There, too, he acquired great substance—flocks and herds, male and female slaves. After returning to Canaan, to his former locality, Abram and Lot separated, because of disputes between their herdsmen, there not being sufficient room for all their cattle in common. After this separation the possession of Canaan was again assured to Abram and to his seed, who should be exceedingly numerous.

Jehovah again promised to Abram a numerous offspring, with the possession of Canaan. He also concluded a covenant with him in a solemn form, and revealed the fortunes of his posterity in Egypt, with their deliverance from bondage. In consequence of the barrenness of Sarai, she gave her handmaid Hagar to Abram, who, becoming pregnant by him, was haughtily treated by her mistress, and fled towards Egypt. But an angel met her in the desert and sent her back, telling of a numerous race that should spring from her. Having returned, she gave birth to Ishmael, in the 86th year of Abram's age.

Again did Jehovah appear to the patriarch, promising as before a multitudinous seed, and changing his name in conformity with such promise. He assured him and his posterity of the possession of Canaan, and concluded a covenant with him for all time. At the institution of circumcision on this occasion, Sarai's name was also changed, because she was to be the maternal progenitor of the covenant people through Isaac her son. Abram, and all the males belonging to him, were then circumcised. He had become acquainted with the rite in Egypt, and transferred it to his household, making it a badge of distinction between the worshippers of the true God and the idolatrous Canaanites—the symbol of the flesh's subjection to the spirit. Its introduction into the worship of the colony at Mamre indicated a decided advance in Abram's religious conceptions. He had got beyond the cruel practice of human sacrifice. The gross worship of the Canaanites was left behind; and the small remnant of it which he retained comported with a faith approaching monotheism. Amid prevailing idolatry this institution was a protection to his family and servants—a magic circle drawn around them. But, though powerful and respected wherever his name was known, he confined the rite to his own domestics, without attempting to force it on the inhabitants of the land where he sojourned. The punishment of death for neglecting it, because the uncircumcised person was

thought to be a breaker of the covenant and a despoiler of its Author, seems a harsh measure on the part of Abram; yet it can hardly be counted an arbitrary transference of the later Levitical severities to the progenitor of the race, since it is in the Elohist.

Accompanied by two angels, Jehovah appeared again to Abram at the oak of Mamre, accepted his proposed hospitality, and promised him a son by Sarai within a year. Though she laughed incredulously, the promise was definitely repeated. When the angels left, Jehovah communicated to Abram the divine purpose of destroying the dwellers in Siddim because of their wickedness, but acceded to the patriarch's intercession, that the cities of the plain should be spared if ten righteous men could be found in them. The two angels who had gone before, arrived at Sodom in the evening, and were entertained by Lot, but threatened with shameful treatment by the depraved inhabitants. Seeing that the vengeance of Heaven was deserved, they proceeded to execute it, saving Lot with his wife and two daughters, and sparing Zoar as a place of refuge for them. Jehovah rained down fire and brimstone from Heaven, turning all the Jordan district to desolation, so that, when Abram looked next morning from the spot where Jehovah and himself had parted, he saw a thick smoke ascend from the ruins.

Abram then journeyed from Hebron to the Negeb, settled between Kadesh and Shur in Gerar, where Sarai is said to have been treated as a prior account makes her to have been in Egypt.

Abram was now commanded by God to offer up Isaac in the land of Moriah. Proceeding to obey, he was prevented by an angel just as he was about to slay his son, and sacrificed a ram that presented itself at the time. In reward of his obedience he received the promise of a numerous seed and abundant prosperity. Thence he returned to Beersheba.

Sarah died and was buried in the cave of Machpelah near Hebron, which Abram purchased, with the adjoining field, from Ephron the Hittite.

We cannot adopt the opinion of Von Bohlen and Dozy that Abram is a mythical person. He must be regarded as a historical character, though the accounts of his life have mythical elements intermingled with much that is traditional or legendary.

The religion of Abram was not pure Jehovahism. According to Exodus vi. 3, the name Jehovah was unknown before Moses. Pure Jehovahism was a growth not reached before the prophets. It was a late development, the creed of most spiritual teachers, not of the people generally.

It is impossible to get chronological exactness in Abram's biography, because it is composed of different traditions incorporated with one another.

ABRAHAM, THE HEIGHTS OF, the elevated plain near the city of Quebec, where Gen. WOLFE (*q.v.*) defeated MONTCALM (*q.v.*), September 13, 1759.

ABRAHAM-A-SANCTA-CLARA was born at Krähenheimstetten, a village in Suabia, on the 4th of June, 1642. In 1662 he joined the order of Barefooted Augustinians. In this order he rose step by step until he became prior provincialis and definitor of his province. He was appointed court preacher at Vienna in 1669. There the people flocked in crowds to hear him, attracted by the force and homeliness of his language, the grotesqueness of his humor, and the impartial severity with which he lashed the follies of all classes of society. The vices of courtiers and court-life in particular were exposed with an admirable intrepidity. He died in Vienna on the 1st of December, 1709.

ABRANTES, a town of Portugal, Estremadura province, on the Tagus, about 70 miles N. E. of Lisbon,

delightfully situated on the brow of a hill, of which the slopes are covered with olive trees, gardens and vineyards. Population about 6000.

ABRANTES, DUKE AND DUCHESS OF. See JUNOT.

ABRAXAS, or ABRASAX, a word engraved on certain antique stones, which were called on that account *Abraxas stones*, and were used as amulets or charms. The Basilidians, a Gnostic sect, attached importance to the word, if, indeed, they did not bring it into use. The letters of *ἀβραξας*, in the Greek notation, make up the number 365, and the Basilidians gave the name to the 365 orders of spirits, which, as they conceived, emanated in succession from the Supreme Being. The Abraxas stones, which are frequently to be met with in the cabinets of the curious, are of very little value.

ABRUZZO, originally one of the four provinces of the continental part of the kingdom of the two Sicilies, afterward subdivided into Abruzzo Ulteriore I., Abruzzo Ulteriore II., and Abruzzo Citeriore, which were so named from their position relative to Naples, and now form three of the provinces of the kingdom of Italy. Though presenting to the Adriatic a coast of about 80 miles in length, they have not a single good port. This territory is mostly rugged, mountainous, and covered with extensive forests, but contains also many fertile and well-watered valleys. The Apennines traverse its whole extent, running generally from N. W. to S. E., and here attaining their greatest elevation. The country is watered by numerous small rivers, most of which fall into the Adriatic. The climate varies with the elevation, but, generally speaking, is temperate and healthy. Agriculture is but little understood or attended to, although in many of the lower parts of the country the land is fertile. The principal productions are corn, hemp, flax, almonds, olives, figs, grapes, and chestnuts. The rearing and tending of sheep is the chief occupation of the inhabitants of the highlands, the wool being of a superior quality. Bears, wolves, and wild boars inhabit the mountain fastnesses; and in the extensive oak forests numerous herds of swine are fed, the hams of which are in high repute. The manufactures are very inconsiderable, being chiefly woollen, linen, and silk stuffs, and earthen and wood wares. Abruzzo was of great importance to the kingdom of Naples, being its chief defense to the north, and presenting almost insurmountable difficulties to the advance of an enemy.

ABSALOM (*father of peace*), the third son of David, king of Israel. He was deemed the handsomest man in the kingdom. His sister Tamar having been violated by Amnon, David's eldest son, Absalom caused his servants to murder Amnon at a feast, to which he had invited all the king's sons. After this deed he fled to the kingdom of his maternal grandfather, where he remained three years; and it was not until two years after his return that he was fully reinstated in his father's favor. Absalom seems to have been by this time the eldest surviving son of David, but he was not the destined heir of his father's throne. The suspicion of this excited the impulsive Absalom to rebellion. For a time the tide of public opinion ran so strong in his favor that David found it expedient to retire beyond the Jordan. But, instead of adopting the prompt measures which his sagacious counselor Ahithophel advised, Absalom loitered at Jerusalem till a large force was raised against him, and when he took the field his army was completely routed. The battle was fought in the forest of Ephraim; and Absalom, caught in the boughs of a tree by the superb hair in which he gloried, was run through the body by Joab. The king's grief for his worthless son vented itself in the touching lamentation—"O my son Absalom, my son, my son Absalom!

would God I had died for thee, O Absalom, my son, my son!"

ABSALON, Archbishop of Lund, in Denmark, was born in 1128, near Sorø, in Zealand, his family name being Axel. In 1148 he went to study at Paris, where a college for Danes had been established. In 1157 he was chosen Bishop of Roskilde or Rothschild. In that age warlike pursuits were not deemed inconsistent with the clerical office, and Absalon was a renowned warrior by sea and land, as well as a zealous ecclesiastic, his avowed principle being that "both swords, the spiritual and the temporal, were intrusted to the clergy." To his exertions as statesman and soldier Waldemar was largely indebted for the independence and consolidation of his kingdom. He died in 1201.

ABSCISS, in *Surgery* (from *abscedo*, to separate), a collection of pus among the tissues of the body, the result of inflammation. Abscesses are divided into acute and chronic. See **SURGERY**.

ABSENTEE, a term of reproach applied to landowners who derive their rent from one country and spend it in another. Absenteeism has for many years afflicted Ireland, and is one of the chief causes of the economic troubles of that country.

ABSINTHE, a liqueur or aromatised spirit, prepared by pounding the leaves and flowering tops of various species of wormwood, with angelica root, sweet flag root, the leaves of dittany of Crete, star-anise fruit, and other aromatics, and macerating these in alcohol. After soaking for about eight days the compound is distilled, yielding an emerald-colored liquor, to which a proportion of an essential-oil, usually that of anise, is added. The liqueur thus prepared constitutes the genuine *Extrait d'Absinthe* of the French. The chief seat of the manufacture is in the canton of Neuchâtel, in Switzerland, although absinthe distilleries are scattered generally throughout Switzerland and France. The liqueur is chiefly consumed in France, but there is also a considerable export trade to the United States of America. In addition to the quantity distilled for home consumption in France, the amount imported from Switzerland in recent years has not been less than 2,000,000 gallons yearly. The introduction of this beverage into general use in France is curious. During the Algerian war (1844-47) the soldiers were advised to mix absinthe with their wine as a febrifuge. On their return they brought with them the habit of drinking it, which is now so widely disseminated in French society.

ABSOLUTE (from the Latin *absolvere*), having the general meaning of *loosened from*, or *unrestricted*, in which sense it is popularly used to qualify such words as "monarchy" or "power," has been variously employed in philosophy. For absolute in its more strictly metaphysical use, see **METAPHYSICS**.

ABSOLUTION, a term used in civil and ecclesiastical law, denotes the act of setting free or acquitting. In a criminal process it signifies the acquittal of an accused person on the ground that the evidence has either disproved or failed to prove the charge brought against him. The ecclesiastical usage of the word is essentially different from the civil. It refers to sin actually committed, and denotes the setting of a person free from its guilt, or from its penal consequences, or from both. It is invariably connected with penitence, and some form of confession, the Scripture authority, to which the Roman Catholics, the Greek Church, and Protestants equally appeal, being found in John xx. 23, James v. 16, etc. In the primitive church the injunction of James was literally obeyed, and confession was made before the whole congregation, whose presence and concurrence were reckoned necessary to the validity of the absolution pronounced by the presbyter. In the

fourth century the bishops began to exercise the power of absolution in their own right, without recognising the congregations. In consequence of this the private confession (*confessio auricularis*) was established, and became more and more common, until it was rendered imperative once a year by a decree of the fourth Lateran Council (1215). A change in the form of absolution was almost a logical sequence of the change in the nature of the confession. At first the priest acted ministerially as an intercessor.

ABSORPTION, in the animal economy, the function possessed by the absorbent system of vessels of taking up nutritive and other fluids. See **PHYSIOLOGY**.

ABSTEMII, a name formerly given to such persons as could not partake of the cup of the eucharist on account of their natural aversion to wine. Calvinists allowed these to commune in the species of bread only, simply touching the cup to their lips; which was by the Lutherans deemed a profanation.

ABSTRACT, the technical name of the summary of title to land, which is furnished by the vendor to the purchaser.

ABSTRACTION, in *Psychology* and *Logic*, is a word used in several distinguishable but closely allied senses. First, in a comprehensive sense, it is often applied to that process by which we fix the attention upon one part of what is present to the mind, to the exclusion of another part; abstraction thus conceived being merely the negative of **ATTENTION**, (*q.v.*) In this sense we are able in thought to *abstract* one object from another, or an attribute from an object, or an attribute perceived by one sense from those perceived by other senses.

ABSRDUM, **REDUCTIO AD**, a mode of demonstrating the truth of a proposition, by showing that its contradictory leads to an absurdity. It is much employed by Euclid.

ABT, FRANZ, born in Prussian Saxony, December 22, 1819; died March 31, 1855. He was educated at Leipzig and became professor of music at Bernburg, Zurich and Weisbaden. He wrote the music of over two hundred popular songs.

ABU, a celebrated mountain of Western India, between 5,000 and 6,000 feet in height, situated in 42° 40' N. lat., and 72° 48' E. long., within the Rājputānā State of Sirohi. It is celebrated as the site of the most ancient Jain temples in India, and attracts pilgrims from all parts of the country. The Jains are the modern Indian representatives of the Buddhists, and profess the ancient theistic doctrines of that sect, modified by saint worship and incarnations. The elevations and platforms of the mountains are covered with elaborately sculptured shrines, temples and tombs. On the top of the hill is a small round platform containing a cavern, with a block of granite, bearing the impression of the feet of Dātā-Bhṛigu, an incarnation of Vishnu. The Emperor Akbar, by a firman dated in the month of Rabi-ul-āul, in the 37th year of his reign, corresponding with 1593, made a grant of the hill and temples of Abu, as well as of the other hills and places of Jain pilgrimage in the empire, to Harbijai Sur, a celebrated preceptor of the Setāmbari sect of the Jain religion. He also prohibited the slaughter of animals at these places. The firman of this enlightened monarch declared that "it is the rule of the worshippers of God to preserve all religions."

ABU-BEKR (*father of the virgin*), was originally called Abd-el-Caaba (*servant of the temple*), and received the name by which he is known historically in consequence of the marriage of his virgin daughter Ayesha to Mohammed. He was born at Mecca in the year 573 A. D., a Koreishite of the tribe of Benn-Taim. Possessed of immense wealth, which he had himself

acquired in commerce, and held in high esteem as judge, an interpreter of dreams, and a depository of the traditions of his race, his early accession to Islamism was a fact of great importance. On his conversion he assumed the name of Abd-Alla (*servant of God*). His own belief in Mohammed and his doctrines was so thorough as to procure for him the title El Siddik (*the faithful*), and his success in gaining converts was correspondingly great. In his personal relationship to the prophet he showed the deepest veneration and most unswerving devotion. When Mohammed fled from Mecca, Abu-Bekr was his sole companion, and shared both his hardships and his triumphs, remaining constantly with him until the day of his death. During his last illness the prophet indicated Abu-Bekr as his successor, by desiring him to offer up prayer for the people. Omar, fearing that the sayings of the prophet would be entirely forgotten when those who had listened to them had all been removed by death, induced Abu-Bekr to see to their preservation in a written form. The record, when completed, was deposited with Hafsu, daughter of Omar. Abu-Bekr died August 23, 634.

ABU-KLEA, a point in the desert near the great bend of the Nile above Khartoum, where the British forces and those of the MAHDI (*q.v.*) fought a desperate battle January 17, 1885, where Col. Fred BURNABY (*q.v.*) was killed.

ABULFARAGIUS, GREGOR ABULFARAJ (called also BARHEBRÆUS, from his Jewish parentage), was born at Malatia, in Armenia, in 1226. His father, Aaron, was a physician, and Abulfaragius, after studying under him, also practised medicine with great success. Abulfaragius wrote a large number of works on various subjects, but his fame as an author rests chiefly on his *History of the World*, from the creation to his own day. It was written in Syriac, and then, after a considerable interval, an abridged version in Arabic was published by the author. He died in 1286.

ABULFAZL, vizier and historiographer of the great Mongol emperor, Akbar, was born about the middle of the 16th century, the precise date being uncertain. His career as a minister of state, brilliant though it was, would probably have been by this time forgotten but for the record he himself has left of it in his celebrated history, the *Akbar Nameh*, or *Book of Akbar*. Abulfazl died by the hand of an assassin, while returning from a mission to the Deccan in 1602.

ABULFEDA, ISMAEL BEN-ALI, EMAD-EDDIN, the celebrated Arabian historian and geographer, born at Damascus in the year 672 of the Hegira (1273 A.D.), was directly descended from Ayub, the father of the emperor Saladin. In his boyhood he devoted himself to the study of the Koran and the sciences, but, from his twelfth year, he was almost constantly engaged in military expeditions, chiefly against the crusaders. In 1285 he was present at the assault of a stronghold of the Knights of St. John, and he took part in the sieges of Tripoli, Acre and Roum. For twenty years, till his death, in October 1331, he reigned in tranquillity and splendor, devoting himself to the duties of government and to the composition of the works to which he is chiefly indebted for his fame. He was a munificent patron of men of letters, who repaired in large numbers to his court. Abulfeda's chief historical work is *An Abridgement of the History of the Human Race*, in the form of annals, extending from the creation of the world to the year 1328. MSS. of Abulfeda's great works are preserved in the Bodleian Library and in the National Library of France.

ABULGHAZI-BAHADUR (1605-1663), a khan of Kiva, of the race of Genghis-Khan, who, after abdicating in favor of his son, employed his leisure in

writing a history of the Mongols and Tartars. He produced a valuable work, which has been translated into German, French, and Russian.

ABUNA, the title given to the archbishop or metropolitan of Abyssinia.

ABUSHEHR. See BUSHIRE.

ABU-SIMBEL, or IPSAMBUL, the ancient *Abocis* or *Abuncis*, a place in Nubia, on the left bank of the Nile, about 50 miles S.W. of Derr, remarkable for its ancient Egyptian temples and colossal figures hewn out of the solid rock. For a description of these see NUBIA.

ABU-TEMAN, one of the most highly esteemed of Arabian poets, was born at Djacem in the year 190 of the Hegira (806 A.D.) Arabian historians assert that a single poem frequently gained for him many thousand pieces of gold. Abu-Teman died 845 A.D.

ABYDOS (1), in *Ancient Geography*, a city of Mysia, in Asia Minor, situated on the Hellespont, which is here scarcely a mile broad. It was here that Xerxes crossed the straits on his celebrated bridge of boats when he invaded Greece. Abydos was celebrated for the vigorous resistance it made when besieged by Philip II. of Macedonia, and is famed in story for the loves of Hero and Leander.

ABYDOS (2), in *Ancient Geography*, a town of Upper Egypt, a little to the west of the Nile, between Ptolemais and Diospolis Parva, famous for the palace of Memnon and the temple of Osiris.

ABYSSINIA is an extensive country of Eastern Africa, the limits of which are not well defined, and authorities are by no means agreed respecting them. It may, however, be regarded as lying between 7° 30' and 15° 40' N. lat., and 35° and 40° 30' E. long., having, N. and N.W., Nubia; E., the territory of the Danakils; S., the country of the Gallas; and W., the regions of the Upper Nile. It has an area of about 150,000 square miles, and a population of 3,500,000.

The name Abyssinia, or more properly Habessinia, is derived from the Arabic word *Habesch*, which signifies mixture or confusion, and was applied to this country by the Arabs on account of the mixed character of the people.

The country of Abyssinia rises rather abruptly from the low arid district on the borders of the Red Sea in lofty ranges of mountains, and slopes away more gradually to the westward, where the tributaries of the Nile have formed numerous deep valleys. It consists for the most part of extensive and elevated table-lands, with mountain ranges extending in different directions, and intersected by numerous valleys. The table-lands are generally from 6000 to 9000 feet above the level of the sea, but in the south there are some of considerable extent, which attain a height of 10,000 feet. The mountains in various parts of the country rise to 12,000 and 13,000 feet above the sea, and some of the peaks of Samen are said to reach to 15,000 feet, and to be always covered with snow. The whole country presents the appearance of having been broken up and tossed about in a remarkable manner, the mountains assuming wild and fantastic forms, with sides frequently abrupt and precipitous, and only accessible by very difficult passes. The Samen range of mountains are the highest in Abyssinia, and together with the Lamalmon and Lasta mountains form a long but not continuous chain, running from north to south.

The principal rivers of Abyssinia are tributaries of the Nile. The western portion of the country may be divided into three regions, drained respectively by the Mareb, the Atbara, and the Abai. The most northern of these rivers is the Mareb, which rises in the mountains of Taranta, flows first south, then west, and afterwards turns to the north, where it is at length, after a course

of upwards of 500 miles, lost in the sand, but in the rainy season it falls into the Atbara.

Abyssinia is said to enjoy "probably as salubrious a climate as any country on the face of the globe."—*Parkyns*. The heat is by no means oppressive, a fine light air counteracting the power of the sun; and during the rainy season, the sky being cloudy, the weather is always agreeable and cool, while the rain itself is not very severe. In certain of the low valleys, however, malarious influences prevail before and after the rainy season, and bring on dangerous fevers. On the higher parts the cold is sometimes intense, particularly at night. The natural division of the seasons is into a cold, a hot, and a rainy season. The cold season may be said to extend from October to February, the hot from the beginning of March to the middle of June, and the wet or monsoon period from this time to the end of September.

On the summits and slopes of the highest mountains the vegetation is of a thoroughly temperate and even English character; the plateaux have a flora of the same character; while on the lower slopes of the hills and in the ravines occur many trees and shrubs of warmer climes. "The general appearance of the plateaux and plains is that of a comparatively bare country, with trees and bushes thinly scattered over it, and clumps and groves only occurring round villages and churches. But the glens and ravines in the plateau sides, each with its little bright spring, are often thickly wooded, and offer a delicious contrast to the open country. The low grounds produce also a kind of corn called *tocussa*, of which a black bread is made, which constitutes the food of the lower classes. Coffee grows wild on the western mountains, and the vine and sugar-cane are cultivated in favorable localities. Cotton is also grown to a considerable extent. Among the fruit-trees are the date, orange, lemon, pomegranate, and banana. Myrrh, balsam, and various kinds of valuable medicinal plants are common.

Most of the domestic animals of Europe are found here. The cattle are in general small, and the oxen belong to the humped race. The famous Galla oxen have horns sometimes four feet long. The sheep belong to the short and fat-tailed race, and are covered with wool. Goats are very common, and have sometimes horns two feet in length. The horses are strong and active. Of wild animals the spotted hyæna is among the most numerous, as well as the fiercest and most destructive, not only roaming in immense numbers over the country, but frequently entering the towns, and even the houses of the inhabitants.

The birds of Abyssinia are very numerous, and many of them remarkable for the beauty of their plumage. Great numbers of eagles, vultures, hawks, and other birds of prey are met with; and partridges, snipes, pigeons, parrots, thrushes, and swallows are very plentiful.

The inhabitants of Abyssinia form a number of different tribes, and evidently belong to several distinct races. The majority are of the Caucasian race, and are in general well-formed and handsome, with straight and regular features, lively eyes, hair long and straight or somewhat curled, and color dark olive, approaching to black. Rüppell regards them as identical in features with the Bedouin Arabs. The tribes inhabiting Tigré, Amhara, Agow, &c., belong to this race. The Galla race, who came originally from the south, have now overrun the greater part of the country, constituting a large portion of the soldiery, and, indeed, there are few of the chiefs who have not an intermixture of Galla blood in their veins. They are fierce and turbulent in character, and addicted to cruelty. Many of them are

still idolaters, but most of them have now adopted the Mohammedan faith, and not a few of them the Christianity of the Abyssinians. They are generally large and well-built, of a brown complexion, with regular features, small deeply-sunk but very bright eyes, and long black hair. A race of Jews, known by the name of Falashas, inhabit the district of Samen.

The prevailing religion of Abyssinia is a very corrupted form of Christianity. This is professed by the majority of the people, as well as by the reigning princes of the different states. There are also scattered over the country many Mohammedans and some Falashas or Jews. Christianity was introduced into this country about the year 330, but since that time it has been so corrupted by errors of various kinds as to have become little more than a dead formality mixed up with much superstition and Judaism.

In manners the Abyssinians are rude and barbarous. Engaged as they are in continual wars, and accustomed to bloodshed, human life is little regarded among them. Murders and executions are frequent, and yet cruelty is said not to be a marked feature of their character; and in war they seldom kill their prisoners. When one is convicted of murder, he is handed over to the relatives of the deceased, who may either put him to death or accept a ransom. When the murdered person has no relatives, the priests take upon themselves the office of avengers. The Abyssinians are irritable, but easily appeased; and are a gay people, fond of festive indulgences. On every festive occasion, as a saint's day, birth, marriage, &c., it is customary for a rich man to collect his friends and neighbors, and kill a cow and one or two sheep.

Abyssinia is one of the most ancient monarchies in the world, and has been governed from time immemorial by an emperor. For many years, however, until the accession of the late Emperor Theodore, he had been a mere puppet in the hands of one or other of his chiefs. Each chief is entire master of all sources of revenue within his territory, and has practically full power of life and death. His subjection consists in an obligation to send from time to time presents to his superior, and to follow him to war with as large a force as he can muster.

The three principal provinces of Abyssinia are Tigré in the north, Amhara (in which Gondar the capital is situated) in the centre, and Shoa in the south. The geographical position of Tigré enhances its political importance, as it lies between Gondar and the sea at Massowah, and thus holds, as it were, the gate of the capital.

The principal towns are Gondar in Amhara, the former capital of the kingdom, and containing about 7000 inhabitants. Debra Tabor in Amhara, formerly a small village, but which rose to be a place of considerable size in consequence of the Emperor Theodore having fixed upon it as his residence, and near it was Gaffat, where the European workmen reside. The capital of Shoa is Ankobar, and near it is Angolala, also a place of considerable size. The capital of Agamé is Adigerat.

The language of the religion and literature of the country is the Geez, which belongs to the Ethiopic class of languages, and is the ancient language of Tigré; of this the modern Tigré is a dialect. The Amharic, the language of Amhara, is that of the court, the army, and the merchants, and is that too which travellers who penetrate beyond Tigré have occasion to use. But the Agow in its various dialects is the language of the people in some provinces almost exclusively, and in others, where it has been superseded by the language of the dominant race, it still exists among the lowest classes. This last is believed to be the original language of the people; and from the affinity of the Geez, Amharic, and cognate dialects, to the Arabic, it seems probable that they were introduced

by conquerors or settlers from the opposite shores of the Red Sea.

The trade and manufactures of Abyssinia are insignificant, the people being chiefly engaged in agriculture and pastoral pursuits. Cotton cloths, the universal dress of the country, are made in large quantities. The preparation of leather and parchment is also carried on to some extent, and manufactures of iron and brass.

Abyssinia, or at least the northern portion of it, was included in the ancient kingdom of Ethiopia. The connection between Egypt and Ethiopia was in early times very intimate, and occasionally the two countries were under the same ruler, so that the arts and civilization of the one naturally found their way into the other. In early times, too, the Hebrews had commercial intercourse with the Ethiopians; and according to the Abyssinians, the Queen of Sheba, who visited Solomon, was a monarch of their country, and from her son Menilek the kings of Abyssinia are descended. During the captivity many of the Jews settled here, and brought with them a knowledge of the Jewish religion. Under the Ptolemies, the arts as well as the enterprise of the Greeks entered Ethiopia, and led to the establishment of Greek colonies. Christianity was introduced into the country by Frumenius, who was consecrated first bishop of Abyssinia by St. Athanasius of Alexandria about A.D. 330. Subsequently the monastic system was introduced, and between 470 and 480 a great company of monks appear to have entered and established themselves in the country. Since that time Monachism has been a power among the people, and not without its influence on the course of events. In 522 the king of the Homerites, on the opposite coast of the Red Sea, having persecuted the Christians, the Emperor Justinian requested the king of Abyssinia, Caleb or Elesbaan, to avenge their cause. He accordingly collected an army, crossed over into Arabia, and conquered Yemen, which remained subject to Abyssinia for 67 years. This was the most flourishing period in the annals of the country. The Ethiopians possessed the richest part of Arabia, carried on a large trade, which extended as far as India and Ceylon, and were in constant communication with the Greek empire.

Towards the close of the 15th century the Portuguese missions into Abyssinia commenced. A belief had long prevailed in Europe of the existence of a Christian kingdom in the far east, whose monarch was known as Prester John, and various expeditions had been sent in quest of it. Among others who had engaged in this search was Pedro de Covilham, who arrived in Abyssinia in 1490, and, believing that he had at length reached the far-famed kingdom, presented to the Negus, or emperor of the country, a letter from his master the king of Portugal, addressed to Prester John. Covilham remained in the country, but in 1507 an Armenian named Matthew was sent by the Negus to the king of Portugal to request his aid against the Turks. In 1520 a Portuguese fleet, with Matthew on board, entered the Red Sea in compliance with this request, and an embassy from the fleet visited the country of the Negus, and remained there for about six years.

It was about the middle of the 16th century that the Galla tribes first entered Abyssinia from the south; and notwithstanding frequent efforts to dislodge them, they gradually extended and strengthened their positions till they had overrun the greater part of the country. The power of the emperor was thus weakened, independent chiefs set themselves up in different parts, until at length he became little better than a puppet in the hands of the most powerful of his chiefs. In 1805 the country was visited by Lord Valentia and Mr. Salt, and again by Salt in 1810. In 1829 Messrs. Gobat and Kugler were sent out as missionaries by the Church

Missionary Society, and were well received by the Ras of Tigré. Mr. Kugler died soon after his arrival, and his place was subsequently supplied by Mr. Isenberg, who was followed by Messrs. Blumhardt and Krapf. In 1830 Mr. Gobat proceeded to Gondar, where he also met with a favorable reception. In 1833 he returned to Europe, and published a journal of his residence here. In the following year he went back to Tigré, but in 1836 he was compelled to leave from ill health. In 1838 other missionaries were obliged to leave the country, owing to the opposition of the native priests.

Lij Kassa, who came subsequently to be known as the Emperor Theodore, was born at Kuara, a western province of Abyssinia, about the year 1818. His father was of noble family, and his uncle was governor of the provinces of Dembea, Kuara, and Chelga. He was educated in a convent, but, preferring a wandering life, he became leader of a band of malcontents. On the death of his uncle he was made governor of Kuara, but, not satisfied with this, he seized upon Dembea, and having defeated several generals sent against him, peace was restored on his receiving Tavavitch, daughter of Ras Ali, in marriage. This lady is said to have been his good genius and counsellor, and during her life his conduct was most exemplary. He next turned his arms against the Turks, but was defeated; and the mother of Ras Ali having insulted him in his fallen condition, he proclaimed his independence. The troops sent against him were successively defeated, and eventually the whole of the possessions of Ras Ali fell into his hands. He next defeated the chief of Godjam, and then turned his arms against the governor of Tigré, whom he totally defeated in February, 1855. In March of the same year he took the title of Theodore III., and caused himself to be crowned king of Ethiopia by the Abuna. Theodore was now in the zenith of his career. He reduced the kingdom of Shoa, and took Ankobar, the capital; but in the meantime his own people were groaning under his heavy exactions, rebellions were breaking out in various parts of his provinces, and his good queen was now dead. He lavished vast sums of money upon his army, which at one time amounted to 100,000 or 150,000 fighting men; and in order to meet this expenditure, he was forced to exact exorbitant tributes from his people. The British consul, Plowden, who was very strongly attached to Theodore, having been ordered by his Government in 1860 to return to Massowah, was attacked on his way by a rebel named Garred, mortally wounded, and taken prisoner. Theodore attacked the rebels, and in the action the murderer of Mr. Plowden was slain by his friend and companion Mr. Bell, but the latter lost his life in preserving that of Theodore. The deaths of the two Englishmen were terribly avenged by the slaughter or mutilation of nearly 2000 rebels. Theodore soon after married his second wife Terunish, the proud daughter of the late governor of Tigré, who felt neither affection nor respect for the upstart who had dethroned her father, and the union was by no means a happy one. In 1862 he made a second expedition against the Gallas, which was stained with atrocious cruelties. Theodore had now given himself up to intoxication and lust. When the news of Mr. Plowden's death reached England, Captain Cameron was appointed to succeed him as consul, and arrived at Massowah in February, 1862. He proceeded to the camp of the king, to whom he presented a rifle, a pair of pistols, and a letter in the Queen's name. In October Captain Cameron was dismissed by Theodore, with a letter to the Queen of England, which reached the Foreign Office on the 12th of February, 1863. For some reason or other this letter was put aside and no answer returned, and to this in no small degree is to be

attributed the difficulties that subsequently arose with that country. After forwarding the letter, Captain Cameron went to Kassala, the seat of the Egyptian administration in that quarter. Thence he went to Metemeh, where he was taken ill, and in order to recruit his health he returned to Abyssinia, and reached Jenda in August, 1863. In November despatches were received from England, but no answer to the emperor's letter, and this, together with the consul's visit to Kassala, greatly offended him, and in January 1864 Captain Cameron and his suite, with Messrs. Stern and Rosenthal, were cast into prison.

In July 1867, it was resolved to send an army into Abyssinia to enforce the release of the captives, and Sir Robert Napier was appointed commander-in-chief. The force amounted to upwards of 16,000 men, besides 12,640 belonging to the transport service, and followers, making in all upwards of 32,000 men. The task to be accomplished was to march over 400 miles of a mountainous and little-known country, inhabited by savage tribes, to the camp or fortress of Theodore, and compel him to deliver up his captives. The commander-in-chief landed on 7th January, 1868, and soon after the troops began to move forward. In the meantime Theodore had been reduced to great straits. His army was rapidly deserting him, and he could hardly obtain food for his followers. He resolved to quit his capital Debra Tabor, which he burned, and set out with the remains of his army for Magdala. On the afternoon of the 10th of April a force of about 3000 men suddenly poured down upon the English in the plain of Arogié, a few miles from Magdala. They advanced again and again to the charge, but were each time driven back, and finally retired in good order. Early next morning Theodore sent Lieut. Prideaux, one of the captives, and Mr. Flad, accompanied by a native chief, to the English camp to sue for peace. Answer was returned, that if he would deliver up all the Europeans in his hands, and submit to the Queen of England, he would receive honorable treatment. The captives were liberated and sent away, and along with a letter to the English general was a present of 1000 cows and 500 sheep, the acceptance of which would, according to Eastern custom, imply that peace was granted. Through some misunderstanding, word was sent to Theodore that the present would be accepted, and he felt that he was now safe; but in the evening he learned that it had not been received, and despair again seized him. Early next morning he attempted to escape with a few of his followers, but subsequently returned. The same day (13th April) Magdala was stormed and taken, and within they found the dead body of the emperor, who had fallen by his own hand. In 1872 Kassai was crowned king of Abyssinia with great ceremony at Axam, under the title of King Johannes. In that year the governor of Massowah, Munzinger Bey, a Swiss, by command of the Viceroy of Egypt, marched an armed force against the Bogos country. The king solicited the aid of England, Germany, and Russia against the Egyptians, whose troops, however, were after a time withdrawn. In 1885 the Italian government occupied Massowah, but could not bring about peaceful relations with the natives. In January, 1887, three companies of Italian soldiers were attacked and, despite desperate resistance, were massacred.

ACACIA, a genus of shrubs and trees belonging to the natural family Leguminosæ and the section Mimosæ. The flowers are small, arranged in rounded or elongated clusters. The leaves are compound pinnate in general. In some instances, however, more especially in the Australian species, the leaf-stalks become flattened, and serve the purpose of leaves. From some of the species a mucilaginous gum is obtained, which is largely

used in medicine as a demulcent and for mixing drugs in a mass, so as to enable the pharmacist to make pills of a proper consistency and solubility. There are about



Leaf of *Acacia heterophylla*.

420 species of *Acacias* widely scattered over the warmer regions of the globe.

ACADEMY, a suburb of Athens to the north, forming part of the Ceramicus, about a mile beyond the gate named Dypilum. It was said to have belonged to the hero of Academus, but the derivation of the word is unknown. It was surrounded with a wall by Hipparchus, and adorned with walks, groves and fountains by Cimon, the son of Miltiades, who at his death bequeathed it as a public pleasure-ground to his fellow-citizens. The Academy was the resort of Plato, who possessed a small estate in the neighborhood. Here he taught for nearly fifty years, till his death, 348 B.C.; and from these "groves of the Academy where Plato taught the truth," his school, as distinguished from the Peripatetics, received the name of academies.

The same name (*Academia*) was in after times given by Cicero to his villa or country-house near Puteoli. There was composed his famous dialogue, *The Academic Questions*.

Of the academic school of philosophy, in so far as it diverged from the doctrines of its great master (see PLATO), we must treat very briefly, referring the reader for particulars to the founders of the various schools, whose names we shall have occasion to mention.

The Academy lasted from the days of Plato to those of Cicero. As to the number of successive schools, the critics are not agreed. Cicero himself and Varro recognized only two, the old and the new; Sextus Empiricus adds a third, the middle; others a fourth, that of Philo and Charmidas; and some even a fifth, the Academy of Antiochus.

Of the old Academy, the principal leaders were Speusippus, Plato's sister's son, and his immediate successor, Xenocrates of Chalcedon, who with Speusippus accompanied Plato in his journey to Sicily; Polemo, a dissolute young Athenian, who came to laugh at Xenocrates, and remained to listen (Horace, *Sat.*, ii. 3, 253); Crates and Crantor, the latter of whom wrote a treatise, praised by Cicero.

Arceusilus, the successor of Crates, the disciple of Theophrastus and Polemo, was the founder of the second or middle academy. He professed himself the strict follower of Plato, and seems to have been sincerely of opinion that his was nothing but a legitimate development of the true Platonic system. He followed the Socratic method of teaching in dialogues; and, like Socrates, left no writings — at least the ancients were not acquainted with any.

On the fourth and fifth Academies, we need not dwell long. Philo and Antiochus both taught Cicero, and without doubt communicated to him that mild scepticism, that eclecticism compounded of almost equal sympathy with Plato and Zeno, which is the characteristic of his philosophical writings. The Academy exactly corresponded to the moral and political wants of Rome.

With no genius for speculation, the better Romans of that day were content to embrace a system which, though resting on no philosophical basis, and compounded of heterogeneous dogmas, offered, notwithstanding, a secure retreat from religious scepticism and political troubles.

ACADEMY, in its modern acceptation, signifies a society or corporate body of learned men, established for the advancement of science, literature, or the arts.

The first institution of this sort we read of in history was that founded at Alexandria by Ptolemy Soter, which he named the Museum, *μυσaeion*. After completing his conquest of Egypt, he turned his attention to the cultivation of letters and science, and gathered about him a large body of literary men, whom he employed in collecting books and treasures of art. This was the origin of the library of Alexandria, the most famous of the ancient world. Passing by the academies which were founded by the Moors at Grenada, Corduba, and as far east as Samarcand, the next instance of an academy is that founded by Charlemagne at the instigation of the celebrated Alcuin, for promoting the study of grammar, orthography, rhetoric, poetry, history and mathematics. In order to equalize all ranks, each member took the pseudonym of some ancient author or celebrated person of antiquity. For instance, Charlemagne himself was David, Alcuin became Flaccus Albinus. Though none of the labors of this academy have come down to us, it undoubtedly exerted considerable influence in modeling the language and reducing it to rules.

In the following century Alfred founded an academy at Oxford. This was rather a grammar school than a society of learned men, and from it the University of Oxford originated.

But the academy which may be more justly considered as the mother of modern European academies is that of *Floral Games*, founded at Toulouse in the year 1325, by Clemens Isaurus. Its object was to distribute prizes and rewards to the troubadours. The prizes consisted of flowers of gold and silver. It was first recognised by the state in 1694, and confirmed by letters-patent from the king, and its numbers limited to thirty-six. It has, except during a few years of the republic, continued to the present day, and distributes annually the following prizes: An amaranth of gold for the best ode, a silver violet for a poem of sixty to one hundred Alexandrine lines, a silver eglantine for the best prose composition, a silver marigold for an elegy, and a silver lily presented in the last century by M. de Malpeyre for a hymn to the Virgin.

It was the Renaissance which was *par excellence* the era of academies, and as the Italians may be said to have discovered anew the buried world of literature, so it was in Italy that the first and by far the most numerous academies arose. The earliest of these was the *Platonic Academy*, founded at Florence by Cosmo de Medici for the study of the works of Plato, though subsequently they added the explanation of Dante and other Italian authors.

I. SCIENTIFIC ACADEMIES.—*Italy*.—The first society for the prosecution of physical science was that established at Naples, 1560, under the presidency of Baptista Porta. It was called *Academia Secretorum Naturæ* or *de Secretis*. It arose from a meeting of some scientific friends, who assembled at Porta's house and called themselves the *Otiosi*. No member was admitted who had not made some useful discovery in medicine or natural philosophy.

The Royal Academy of Sciences at Turin originated in 1757 as a private society; in 1759 it published a volume of *Miscellanea Philosophico-Mathematica Societatis privatae Taurinensis*; shortly after it was constituted a Royal Society by Charles Emanuel III., and in

1783 Victor Amadeus III. made it a Royal Academy of Sciences.

France.—The *Old Academy of Sciences* originated in much the same way as the French Academy. A private society of scientific men had for some thirty years been accustomed to meet first at the house of Montmort, the maître des requêtes, afterwards at that of Thevenot, a great traveller and man of universal genius, in order to converse on their studies, and communicate their discoveries. To this society belonged, among others, Descartes, Gassendi, Blaise Pascal, and his father.

On 21st December 1792, the old Academy of Sciences met for the last time. Many of the members fell by the guillotine, many were imprisoned, more reduced to indigence. The aristocracy of talent was almost as much detested and persecuted by the Revolution as that of rank.

In 1795 the Convention decided on founding an Institute, which was to replace all the academies. The first class of the Institute corresponded closely to the old academy. See INSTITUTE.

In 1816 the Academy was reconstituted as a branch of the Institute. The new academy has reckoned among its members, besides many other brilliant names, Carnot, the engineer, the physicians Fresnel, Ampère, Arago, Biot, the chemists Gay-Lussac and Thénard, the zoologists G. Cuvier and the two Geoffroy Saint-Hilaires.

The French had also considerable academies in most of their large towns. Montpellier, for example, had a Royal Academy of Sciences, founded in 1706 by Louis XIV., on nearly the same footing as that at Paris, of which, indeed, it was in some measure the counterpart.

Germany.—The *Collegium Curiosum* was a scientific society, founded by J. C. Sturm, professor of mathematics and natural philosophy in the University of Altorff, in Franconia, in 1672, on the plan of the Accademia del Cimento. It originally consisted of 20 members, and continued to flourish long after the death of its founder. The early labors of the society were devoted to the repetition (under varied conditions) of the most notable experiments of the day, or to the discussion of the results.

The *Royal Academy of Sciences at Berlin* was founded in 1700 by Frederic I., after Leibnitz's comprehensive plan, but was not opened until 1711. Leibnitz was the first president. Under Maupertuis, who succeeded him, it did good service. Its present constitution dates from January 24, 1812.

The *Academy of Sciences at Mannheim* was established by Charles Theodore, Elector Palatine, in the year 1755. The plan of this institution was furnished by Schæpflin, according to which it was divided into two classes, the historical and physical.

The *Electoral Bavarian Academy of Sciences at Munich* was established in 1759, and publishes its memoirs under the title of *Abhandlungen der Bayerischen Akademie*.

The *Electoral Academy at Erfurt* was established by the Elector of Mentz, in the year 1754. It consists of a protector, president, director, assessors, adjuncts and associates. Its object is to promote the useful sciences.

Russia.—The *Imperial Academy of Sciences at St. Petersburg* was projected by the Czar Peter the Great. Having in the course of his travels observed the advantage of public societies for the encouragement and promotion of literature, he formed the design of founding an academy of sciences at St. Petersburg.

During the short reign of Peter II. the salaries of the members were discontinued, and the academy utterly neglected by the Court; but it was again patronized by the Empress Anne, who even added a seminary for the education of youth, under the superintendence of the professors.

The Empress Catharine II., with her usual zeal for promoting the diffusion of knowledge, took this useful society under her immediate protection. She altered the court of directors greatly to the advantage of the whole body, corrected many of its abuses, and infused a new vigor and spirit into their researches.

Sweden.—The *Academy of Sciences at Stockholm*, or the *Royal Swedish Academy*, owes its institution to six persons of distinguished learning, among whom was the celebrated Linnaeus. They originally met on the 2d of June 1739, when they formed a private society, in which some dissertations were read; and in the end of the same year their first publication made its appearance. As the meetings continued and the members increased, the society attracted the notice of the king; and, accordingly, on the 31st of March 1741, it was incorporated under the name of the Royal Swedish Academy. Not receiving any commission from the crown, it is merely under the protection of the king, being directed, as the English Royal Society, by its own members. It has now, however, a large fund, which has chiefly arisen from legacies and other donations; but a professor of experimental philosophy, and two secretaries, are still the only persons who receive any salaries.

Denmark.—The *Royal Academy of Science at Copenhagen* owes its institution to the zeal of six individuals, whom Christian VI., in 1742, ordered to arrange his cabinet of medals. The Count of Holstein, its first president, warmly patronized this society, and recommended it so strongly to Christian VI. that, in 1743, his Danish majesty took it under his protection, called it the Royal Academy of Science, endowed it with a fund, and ordered the members to join to their former pursuits natural history, physics, and mathematics.

England.—In 1616 a scheme for founding a Royal Academy was started by Edmund Bolton, an eminent scholar and antiquary. Bolton, in his petition to King James, which was supported by George Villiers, Marquis of Buckingham, proposed that the title of the academy should be "King James, his Academy or College of honour." About 1645 some of the more ardent followers of Bacon used to meet, some in London, some at Oxford, for the discussion of subjects connected with experimental science. This was the origin of the Royal Society, which received its charter in 1662. See ROYAL SOCIETY.

Ireland.—The *Royal Irish Academy* arose out of a society established at Dublin about the year 1782, and consisting of a number of gentlemen, most of whom belonged to the university. They held weekly meetings, and read essays in turn on various subjects.

Holland.—The *Royal Academy of Sciences at Amsterdam*, erected by a royal ordinance 1852, succeeded the Royal Institute of the Low Countries, founded by Louis Napoleon, King of Holland, 1808.

Spain.—The *Academy of Sciences at Madrid*, founded 1774, after the model of the French Academy.

Portugal.—The *Academy of Sciences at Lisbon* is divided into three classes—natural history, mathematics, and national literature. It consists of 24 ordinary and 36 extraordinary members.

II. ACADEMIES OF BELLES LETTERS.—*Italy.*—Italy in the 16th century was remarkable for the number of its literary academies. Tiraboschi, in his *History of Italian Literature* has given a list of 171; and Jarkius, in his *Specimen Historia Academicarum Canditarum*, enumerates nearly 700. Many of these, with a sort of Socratic irony, gave themselves names expressive of ignorance or simply ludicrous. "The first academies of Italy chiefly directed their attention to classical literature; they compared manuscripts; they suggested new readings, or new interpretations; they deciphered in-

scriptions or coins; they sat in judgment on a Latin ode, or debated the propriety of a phrase. Their own poetry had, perhaps, never been neglected; but it was not till the writings of Bembo furnished a new code of criticism in the Italian language, that they began to study it with the same minuteness as modern Latin." "They were encouragers of a numismatic and lapidary erudition, elegant in itself, and throwing for ever little specks of light on the still ocean of the past, but not very favorable to comprehensive observation, and tending to bestow on an unprofitable pedantry the honors of real learning."

Among the numerous other literary academies of Italy we may mention the Academy of Naples, founded about 1440 by Alfonso, the king; the *Academy of Florence*, founded 1540, to illustrate and perfect the Tuscan tongue, especially by a close study of Petrarck; the *Intronati* of Siena, 1525; the *Infiammati* of Padua, 1534; the *Rozzi* of Siena, suppressed by Cosmo, 1568.

The *Academy of Humorists, Umoristi*, had its origin at Rome in the marriage of Lorenzo Marcini, a Roman gentleman, at which several persons of rank were guests.

In 1690 the *Academy or Society of Acadians* was established at Rome, for the purpose of reviving the study of poetry.

The *Royal Academy of Savoy* dates from 1719, and was made a royal academy by Charles Felix in 1848.

Germany.—Of the German literary academies, the most celebrated was *Die Fruchtbbringende Gesellschaft*, the Fruitful Society, established at Weimar 1617. Five princes enrolled their names among the original members. The object was to purify the mother tongue.

France.—The *French Academy* was established by order of the king in the year 1635, but in its original form it came into existence some four or five years earlier. About the year 1629 certain literary friends in Paris agreed to meet weekly at the house of one of their number. The fame of the meetings, though the members were bound over to secrecy, reached at length the ears of Cardinal Richelieu, who conceived so high an opinion of them that he at once promised them his protection, and offered to incorporate them by letters patent. The cardinal was *ex officio* protector. The meetings were weekly as before.

The letters patent were at once granted by the king, but it was only after violent opposition and long delay that the president, who was jealous of the cardinal's authority, consented to grant the verification required by the old constitution of France.

Their numbers were fixed at forty. The original members who formed the nucleus of the body were eight, and it was not till 1639 that the full number was completed. Their first undertaking consisted of essays written by all the members in rotation. To judge by the titles and specimens which have come down to us, these possessed no special originality or merit, but resembled the *ἐπιδείξεις* of the Greek rhetoricians. They next, at the instance of Cardinal Richelieu, undertook a criticism of Corneille's *Cid*, the most popular work of the day. It was a rule of the academy that no work could be criticised except at the author's request. It was only the fear of incurring the cardinal's displeasure which wrung from Corneille an unwilling consent.

We have next to consider the influence of the French Academy on the language and literature, a subject on which the most opposite opinions have been advanced. On the one hand, it has been asserted that it has corrected the judgment, purified the taste, and formed the language of French writers, and that to it we owe the most striking characteristics of French literature, its purity, delicacy, and flexibility. Thus Mr. Matthew Arnold, in his well-known *Essay on the Literary Influ-*

ence of Academies, has pronounced a glowing panegyric on the French Academy as a high court of letters, and rallying point for educated opinion, as asserting the authority of a master in matters of tone and taste. To it he attributes in a great measure that thoroughness, that openness of mind, that absence of vulgarity, which he finds everywhere in French literature; and to the want of a similar institution in England he traces that eccentricity, that provincial spirit, that coarseness, which, as he thinks, is barely compensated by English genius. On the other hand, its inherent defects have been so well summed up by M. Lanfrey, that we cannot do better than quote from his recent *History of Napoleon*. "This institution," he says, speaking of the French Academy, "had never shown itself the enemy of despotism. Founded by the monarchy and for the monarchy, eminently favorable to the spirit of intrigue and favoritism, incapable of any sustained or combined labor, it has substituted pomp for grandeur, school routine for individual inspiration, elaborateness for simplicity, *fadéur* and the monotony of literary orthodoxy for variety, the source and spring of intellectual life; and in the works produced under its auspices we discover the rhetorician and the writer, never the man. By all its traditions the academy was made to be the natural ornament of a monarchical society. Richelieu conceived and created it as a sort of superior centralization applied to intellect, as a high literary court to maintain intellectual unity, and protest against innovation. Bonaparte, aware of all this, had thought of re-establishing its ancient privileges; but it had in his eyes one fatal defect — *esprit*."

Spain.—The *Royal Spanish Academy at Madrid* held its first meeting in July 1713, in the palace of its founder, the Duke d'Escalona. It consisted at first of 8 academicians, including the duke; to which number 14 others were afterwards added, the founder being chosen president or director.

Sweden.—The *Royal Swedish Academy* was founded in the year 1786, for the purpose of purifying and perfecting the Swedish language.

Belgium.—Belgium has always been famous for its literary societies. The little town of Diest boasts that it possessed a society of poets in 1302, and the Catherinists of Alost date from 1107.

The present *Royal Academy of Belgium* was founded by the Count of Coblenz at Brussels, 1769. Count Stahrenberg obtained for it in 1772 letters patent from Maria Theresa, who also granted pensions to all the members, and a fund for printing their works.

III. ACADEMIES OF ARCHÆOLOGY AND HISTORY.—*Italy*.—Under this class the *Academy of Herculaneum* properly ranks. It was established at Naples about 1755, at which period a museum was formed of the antiquities found at Herculaneum, Pompeii, and other places, by the Marquis Tanucci, who was then minister of state. A grand meeting was to be held every year, when the prizes were to be distributed, and analyses of the works read. The first meeting took place on the 25th of April 1807; but the subsequent changes in the political state of Naples prevented the full and permanent establishment of this institution.

France.—The old *Academy of Inscriptions and Belles Lettres* was an off-shoot from the French Academy, which then at least contained the *élite* of the French learning. Louis XIV. was of all French kings the one most occupied with his own aggrandisement. Literature, and even science, he only encouraged as far as they redounded to his own glory. Nor were literary men inclined to assert their independence. Boileau well represented the spirit of the age when, in dedicating his tragedy of *Berenice* to Colbert, he wrote—"The least things become important if in any degree they can serve

the glory and pleasure of the king." Thus it was that the Academy of Inscriptions arose. At the suggestion of Colbert, a company (a committee we should now call it) had been appointed by the king, chosen from the French Academy, charged with the office of furnishing inscriptions, devices, and legends for medals.

But it was to M. de Pontchartrain, comptroller-general of finance and secretary of state, that the academy owed its institution.

By a new regulation, dated the 16th July 1701, the *Royal Academy of Inscriptions and Medals* was instituted, being composed of ten honorary members, ten pensioners, ten associates, and ten pupils.

Among the first honorary members we find the indefatigable Mabillon (excluded from the pensioners by reason of his orders), Père La Chaise, the king's confessor, and Cardinal Rohan; among the associates Fontenelle, and Rollin, whose *Ancient History* was submitted to the academy for revision. In 1716 the regent changed its title to that of the *Academy of Inscriptions and Belles Lettres*, a title which better suited its new character.

In the great battle between the Ancients and the Moderns which divided the learned world in the first half of the 18th century, the Academy of Inscriptions naturally espoused the cause of the Ancients, as the Academy of Sciences did that of the Moderns. During the earlier years of the French Revolution the academy continued its labors uninterruptedly; and on the 22d of January 1793, the day after the death of Louis XVI., we find in the *Proceedings* that M. Bréquigny read a paper on the projects of marriage between Queen Elizabeth and the Dukes of Anjou and Alençon.

In 1816 the academy received again its old name. The *Proceedings* of the Society embrace a vast field, and are of very various merits.

Celtic Academy.—In consequence of the attention of several literary men in Paris having been directed to Celtic antiquities, a *Celtic Academy* was established in that city in the year 1800.

IV. ACADEMIES OF MEDICINE AND SURGERY.—*Germany*.—The Academy of *Natura Curiosi* called also the *Leopoldine Academy*, was founded in 1662, by J. L. Bausch, a physician of Leipsic, who, imitating the example of the English, published a general invitation to medical men to communicate all extraordinary cases that occurred in the course of their practice. The works of the *Natura Curiosi* were at first published separately; but this being attended with considerable inconvenience, a new arrangement was formed, in 1770, for publishing a volume of observations annually.

The *Academy of Surgery* at Vienna was instituted by the present emperor, under the direction of the celebrated Brambilla. In it there were at first only two professors; and to their charge the instruction of a hundred and thirty young men was committed, thirty of whom had formerly been surgeons in the army. But latterly the number both of teachers and pupils was considerably increased.

France.—*Royal Academy of Medicine*.—Medicine is a science which has always engaged the attention of the kings of France. Charlemagne established a school of medicine in the Louvre, and various societies have been founded, and privileges granted to the faculty by his successors.

V. ACADEMIES OF THE FINE ARTS.—*Russia*.—The academy of St. Petersburg was established by the Empress Elizabeth, at the suggestion of Count Shuvaloff, and annexed to the Academy of Sciences. Catharine II. formed it into a separate institution, augmented the annual revenue to £12,000, and increased the number of scholars to three hundred; she also constructed, for

the use and accommodation of the members, a large circular building, which fronts the Neva. The scholars are admitted at the age of six, and continue until they have attained that of eighteen.

France.—The *Academy of Painting and Sculpture at Paris* was founded by Louis XIV. in 1648, under the title of Académie Royale des Beaux Arts, to which was afterward united the Academy of Architecture, erected 1671.

The *Royal Academy of Music* is the name which, by a strange perversion of language, is given in France to the grand opera.

Italy.—In 1778 an Academy of Painting and Sculpture was established at Turin. The meetings were held in the palace of the king, who distributed prizes among the most successful members. In Milan an Academy of Architecture was established so early as the year 1380, by Galeos Visconti. About the middle of the last century an Academy of the Arts was established there, after the example of those at Paris and Rome.

Spain.—In Madrid an Academy for Painting, Sculpture, and Architecture, was founded by Philip V.

Sweden.—An Academy of Fine Arts was founded at Stockholm in the year 1733 by Count Tessin.

England.—The *Royal Academy of Arts in London* was instituted for the encouragement of designing, painting, sculpture, &c., in the year 1768, with Sir J. Reynolds for its president. This academy is under the immediate patronage of the queen, and under the direction of forty artists of the first rank in their several professions.

The *Academy of Ancient Music* was established in London in 1710, by several persons of distinction, and other amateurs, in conjunction with the most eminent masters of the time, with the view of promoting the study and practice of vocal and instrumental harmony. The *Royal Academy of Music* was formed by the principal nobility and gentry of the kingdom, for the performance of operas, composed by Handel, and conducted by him at the theatre in the Haymarket.

ACADIA, the name given to Nova Scotia by the French settlers in 1604. The country was ceded to France by England in 1667, but the English colonists maintained a constant warfare with the French settlers. In 1713 France gave up its claims, and the French-speaking Acadians were promised that they should not be called on to bear arms against their brethren. But in 1755 more than 18,000 of these people were forcibly expatriated, being robbed of their entire possessions.

ACALEPHÆ (a nettle), a name given to the animals commonly known as *jelly-fish*, *sea-blubber*, *sea-nettles*, &c.

ACANTHOCEPHALA, (a thorn, and the head), a group of parasitic worms, having the heads armed with spines or hooks.

ACANTHOPTERYGII, an order of fishes, having bony skeletons with prickly spinous processes in the dorsal fins.

ACANTHUS, a genus of plants belonging to the natural order Acanthaceæ. The species are natives of the southern parts of Europe. It has large, deeply-cut, hairy, shining leaves, which are supposed to have suggested the decoration of the Corinthian column.

ACAPULCO, a town and port in Mexico, on a bay of the Pacific Ocean, about 190 miles S.S.W. of Mexico, in N. lat. 16° 50', W. long. 99° 46'. The harbor, which is the best on the Pacific coast, is almost completely landlocked. The town lies north of the harbor, and is defended by the castle of San Diego, which stands on a eminence. Acapulco was in former times the great depôt of the trade of Spain with the East Indies. The trade between Acapulco and Manilla was annihilated when Mexico became independent; and, from this cause,

and also on account of the frequent earthquakes by which the town has been visited, it had sunk to comparative insignificance, when the discovery of gold in California gave its trade a fresh impetus. It is now the most important seaport in Mexico, and is regularly touched at by the Pacific mail steamers. Population about 5000.

ACARNANIA, a province of ancient Greece, now called Carnia. It was a hilly country, with numerous lakes and tracts of rich pasture, and its hills are to the present day crowned with thick wood. It was celebrated for its excellent breed of horses. Up to the time of the Peloponnesian war, they are mentioned only as a race of rude shepherds, divided into numerous petty tribes, and engaged in continual strife and rapine. They were, however, favorably distinguished from their Ætolian neighbors by the fidelity and steadfastness of their character.

ACARUS, a genus of Arachnides, represented by the cheese mite and other forms.

ACCELERATION is a term employed to denote generally the rate at which the velocity of a body, whose motion is not uniform, either increases or decreases. As the velocity is continually changing, and cannot therefore be estimated, as in uniform motion, by the space actually passed over in a certain time, its value at any instant has to be measured by the space the body would describe in the unit of time, supposing that at and from the instant in question the motion became and continued uniform. If the motion is such that the velocity, thus measured, increases or decreases by equal amounts in equal intervals of time, it is said to be *uniformly* accelerated or retarded.

We have a familiar instance of uniformly accelerated and uniformly retarded motion in the case of bodies falling and rising vertically near the earth's surface, where, if the resistance of the air be neglected, the velocity of the body is increased or diminished, in consequence of the earth's attraction, by a uniform amount in each second of time.

ACCENT, in reading or speaking, is the stress or pressure of the voice upon a *syllable* of a word. The derivation of the term (Lat. *accentus*, *quasi adcantus*) clearly shows that it was employed by the classical grammarians to express the production of a musical effect. Its origin is therefore to be sought in the natural desire of man to gratify the ear by modulated sound, and probably no language exists in which it does not play a more or less important part. The statement sometimes made, that the French have no accent in their words, can only mean that their accent is less emphatic or less variously so than that of certain other nations. If it means more, it is not merely an error, but an absurdity. From this conception of the subject, it is obvious that accent must be fundamentally the same thing in all languages, and must aim more or less successfully at the same results, however diverse the rules by which it is governed.

Passing over the consideration of the accentual system of the Hebrews with the single remark, that it exhibits, though with more elaborate and complicated expression, most of the characteristics both of Greek and English accent, we find that the Greeks employed three grammatical accents, viz., the *acute accent* (´), which shows when the tone of the voice is to be raised; the *grave accent* (`), when it is to be depressed; and the *circumflex accent* (^), composed of both the acute and the grave, and pointing out a kind of undulation of the voice. The Latins have made the same use as the Greeks of these three accents, and various modern nations, French, English, etc., have also adopted them. As to the Greek accents, now seen both in manuscripts and printed books, there has been great dispute about their antiquity and use,

But the following things seem to be undoubtedly taught by the ancient grammarians and rhetoricians :— (1.) That by *accent* (προσῳδία, τόπος) the Greeks understood the elevation or falling of the voice on a particular syllable of a word, either absolutely, or in relation to its position in a sentence, accompanied with an *intension* or *remission* of the vocal utterance on that syllable (ἐντάσις, ἀνεβίς), occasioning a marked predominance of that syllable over the other syllables of the word. The predominance thus given, however, had no effect whatever on the quantity — long or short — of the accented syllable. The accented syllable in Greek as in English, might be long or it might be short; elevation and emphasis of utterance being one thing, and prolongation of the vocal sound quite another thing, as any one acquainted with the first elements of music will at once perceive. The difficulty which many modern scholars have experienced in conceiving how a syllable could be accented and not lengthened, has arisen partly from a complete want of distinct ideas on the nature of the elements of which human speech is composed, and partly also from a vicious practice which has long prevailed in English schools of reading Greek not according to the laws of its own accentuation, but according to the accent of Latin handed down to us through the Roman Catholic Church.

If there is any perplexity regarding the nature or influence of classical accent, there is none about English. It does not conflict or combine with the modulations of quantity. It is the sole determining element in our metrical system. Almost the very earliest of our authors, the Venerable Bede, notices this.

Originally English accent was upon the root, and not upon inflectional syllables. Gotting finds the same principle operating in Greek, but in that language it certainly never exercised the universal sway it does in the earlier forms of English.

But no matter how irregular the time elapsing between the recurrence of the accents, they are always on the root-syllables.

The Norman Conquest, however, introduced a different system, which gradually modified the rigid uniformity of the native English accentuation. The new mode of accentuation soon began to affect even words of pure English origin — e.g., in *Robert of Gloucester* we find *falshede* instead of *falshe*, *tidinge* instead of *tidings*, *trewehede* instead of *trewe*, *gladdore* instead of *gladd*, *wisliche* instead of *wislich*, *begynnyn* instead of *beginning*, *endyn* instead of *ending*. In the *Proverbs of Hendyng* we have *nothyng* for *nothing*, *habben* for *haben*, *fomon* for *forn*; in *Robert of Brunne*, *halydom* for *holiness*, *clothyng* for *clothing*, *gretand* for *greted*.

A change in the position of the accent serves a variety of purposes in English. It distinguishes (1.) a *noun* from a *verb*, as *ac'cent*, *ac'cent'*; *aug'ment*, *aug'ment'*; *tor'ment*, *tor'ment'*; *com'ment*, *com'ment'*; *con'sort*, *con'sort'*; *con'test*, *con'test'*; *con'trast*, *con'trast'*; *di'gest*, *di'gest'*; *dis'count*, *dis'count'*; *in'sult*, *in'sult'*; &c.; (2.) an *adjective* from a *verb*, as *ab'sent*, *ab'sent'*; *fre'quent*, *fre'quent'*; *pre'sent*, *pre'sent'*; *com'pound*, *com'pound'*; &c.; (3.) an *adjective* from a *noun*, as *ex'pert*, *ex'pert'*; *com'pact*, *com'pact'*. It also denotes a difference of meaning, e.g., *con'jure*, *con'jure'*; *in'cense*, *in'cense'*; *au'gust*, *au'gust'*; *su'pine*, *su'pine'*.

Accent has exercised a powerful influence in changing the *forms* of words. Accent in music is analogous with accent in poetry.

ACCEPTANCE is the act by which a person binds himself to comply with the request contained in a bill of exchange addressed to him by the drawer. In all cases it is understood to be a promise to pay the bill *in money*, the law not recognising an acceptance in which

the promise is to pay in some other way, as, for example, partly in money and partly by another bill. Acceptance may be absolute, conditional, or partial.

ACCESSION is applied, in a historical or constitutional sense, to the coming to the throne of a dynasty or line of sovereigns, as the accession of the House of Hanover.

ACCESSORY, a person guilty of a felonious offence, not as principal, but by participation; as by advice, command, aid, or concealment. In treason, accessories are excluded, every individual concerned being considered as a principal. In crimes under the degree of felony, also, all persons concerned, if guilty at all, are regarded as principals.

ACCIAJUOLI, DONATO, was born at Florence in 1428. He was famous for his learning, especially in Greek and mathematics, and for his services to his native state. Having previously been intrusted with several important embassies, he became Gonfalonier of Florence in 1473. He died at Milan in 1478, when on his way to Paris to ask the aid of Louis XI. on behalf of the Florentines against Pope Sixtus IV.

ACCIDENT. An attribute of a thing or class of things, which neither belongs to, nor is in any way deducible from, the essence of that thing or class, is termed its *accident*. An accident may be either inseparable or separable: the former, when we can conceive it to be absent from that with which it is found, although it is always, as far as we know, present, i.e., when it is not necessarily but is universally present; the latter, when it is neither necessarily nor universally present.

ACCIUS, a poet of the 16th century, to whom is attributed *A Paraphrase of Æsop's Fables*, of which Julius Scaliger speaks with great praise.

ACCIUS (or ATTIVS) LUCIUS, a Latin tragic poet, was the son of a freedman, born, according to St. Jerome, in the year of Rome 583, though this appears somewhat uncertain.

ACCLAMATION, the expression of the opinion, favorable or unfavorable, of any assembly by means of the voice. *Applause* denotes strictly a similar expression by clapping of hands, but this distinction in the usage of the words is by no means uniformly maintained. Among the Romans acclamation was varied both in form and purpose. At marriages it was usual for the spectators to shout *Io Hymen, Hymenæ*, or *Talassio*; a victorious army or general was greeted with *Io triumphe*; in the theatre acclamation was called for at the close of the play by the last actor, who said, *Plandite*; in the senate opinions were expressed and votes passed by acclamation in such forms as *Omnes, omnes, Equum est, Justum est*, etc.; and the praises of the emperor were celebrated in certain pre-arranged sentences, which seem to have been chanted by the whole body of senators.

ACCLIMATISATION is the process of adaptation by which animals and plants are gradually rendered capable of surviving and flourishing in countries remote from their original habitats, or under meteorological conditions different from those which they have usually to endure, and which are at first injurious to them.

The subject of acclimatisation is very little understood, and some writers have even denied that it can ever take place. It is often confounded with *domestication* or with *naturalisation*; but these are both very different phenomena. A *domesticated* animal or a cultivated plant need not necessarily be *acclimatised*; that is, it need not be capable of enduring the severity of the seasons without protection. The canary bird is *domesticated*, but not *acclimatised*, and many of our most extensively cultivated plants are in the same category. A *naturalised* animal or plant, on the other hand, must be able to withstand all the vicissitudes of the

seasons in its new home, and it may therefore be thought that it must have been acclimatised. But in many, perhaps most, cases of *naturalisation*, there is no evidence of a gradual adaptation to new conditions which were at first injurious, and this is essential to the idea of *acclimatisation*. On the contrary, many species, in a new country and under somewhat different climatic conditions, seem to find a more congenial abode than in their native land, and at once flourish and increase in it to such an extent as often to exterminate the indigenous inhabitants. Thus Agassiz (in his work on Lake Superior) tells us that the road-side weeds of the north-eastern United States, to the number of 130 species, are all European, the native weeds having disappeared westwards; while in New Zealand there are, according to Mr. T. Kirk (*Transactions of the New Zealand Institute*, vol. ii. p. 131), no less than 250 species of naturalised plants, more than 100 of which spread widely over the country, and often displace the native vegetation. Among animals the European rat, goat, and pig, are naturalised in New Zealand, where they multiply to such an extent as to injure and probably exterminate many native productions. In neither of these cases is there any indication that *acclimatisation* was necessary or ever took place.

On the other hand, the fact that an animal or plant cannot be *naturalised* is no proof that it is not *acclimatised*. It has been shown by Mr. Darwin that, in the case of most animals and plants in a state of nature, the competition of other organisms is a far more efficient agency in limiting their distribution than the mere influence of climate.

Different Degrees of Climatal Adaptation in Animals and Plants.—Plants differ greatly from animals in the closeness of their adaptation to meteorological conditions. Not only will most tropical plants refuse to live in a temperate climate, but many species are seriously injured by removal a few degrees of latitude beyond their natural limits.

Animals, especially the higher forms, are much less sensitive to change of temperature, as shown by the extensive range from north to south of many species.

Acclimatisation by Individual Adaptation.—It is evident that acclimatisation may occur (if it occurs at all) in two ways, either by modifying the constitution of the individual submitted to the new conditions, or by the production of offspring which may be better adapted to those conditions than their parents. The alteration of the constitution of individuals in this direction is not easy to detect, and its possibility has been denied by many writers.

Acclimatisation by Variation.—A mass of evidence exists showing that variations of every conceivable kind occur among the offspring of all plants and animals, and that, in particular, constitutional variations are by no means uncommon. Among cultivated plants, for example, hardier and more tender varieties often arise.

Constitutional Adaptation often accompanied by External Modification.—Although in some cases no perceptible alteration of form or structure occurs when constitutional adaptation to climate has taken place, in others it is very marked. Mr. Darwin has collected a large number of cases in his *Animals and Plants under Domestication* (vol. ii., p. 277), of which the following are a few of the most remarkable. Dr. Falconer observed that several trees, natives of cooler climates, assumed a pyramidal or fastigate form when grown in the plains of India; cabbages rarely produce heads in hot climates; the quality of the wood, the medicinal products, the odor and color of the flowers, all change in many cases when plants of one country are grown in another.

In his *Contributions to the Theory of Natural Selection*, Mr. Wallace has recorded cases of simultaneous variation among insects, apparently due to climate or other strictly local causes. He finds that the butterflies of the family *Papilionidae*, and some others, become similarly modified in different islands and groups of islands.

The Influence of Heredity.—Adaptation by variation would, however, be a slow and uncertain process, and might for considerable periods of time cease to act, did not heredity come into play. This is the tendency of every organism to produce its like, or more exactly, to produce a set of new forms varying slightly from it in many directions—a group of which the parent form is the centre. If now one of the most extreme of these variations is taken, it is found to become the centre of a new set of variations; and by continually taking the extreme in the same direction, an increasing variation in that direction can be effected, until checked by becoming so great that it interferes with the healthy action of the organism, or is in any other way prejudicial. It is also found that acquired constitutional peculiarities are equally hereditary; so that by a combination of those two modes of variation any desired adaptation may be effected with greater rapidity.

Evidence has been adduced by Mr. Darwin to show that the tendency to vary is itself hereditary; so that, so far from variations coming to an end, as some persons imagine, the more extensively variation has occurred in any species in the past, the more likely it is to occur in the future.

Selection and Survival of the Fittest as Agents in Naturalisation.—We may now take it as an established fact, that varieties of animals and plants occur, both in domesticity and in a state of nature, which are better or worse adapted to special climates. There is no positive evidence that the influence of new climatal conditions on the parent has any tendency to produce variations in the offspring better adapted to such conditions, although some of the facts mentioned in the preceding sections render it probable that such may be the case. Neither does it appear that this class of variations is very frequent. It is, however, certain that whenever any animal or plant is largely propagated constitutional variations will arise, and some of these will be better adapted than others to the climatal and other conditions of the locality.

The Method of Acclimatisation.—Taking into consideration the foregoing facts, it may be considered as proved—*1st*, That habit has little (though it appears to have some) definite effect in adapting the constitution of animals to a new climate; but that it has a decided, though still slight, influence in plants when, by the process of propagation by buds, shoots, or grafts, the individual can be kept under its influence for long periods; *2d*, That the offspring of both plants and animals vary in their constitutional adaptation to climate, and that this adaptation may be kept up and increased by means of heredity; and, *3d*, That great and sudden changes of climate often check reproduction even when the health of the individuals does not appear to suffer. In order, therefore, to have the best chances of acclimatising any animal or plant in a climate very dissimilar from that of its native country, and in which it has been proved that the species in question cannot live and maintain itself without acclimatisation, we must adopt some such plan as the following:—

1. We must transport as large a number as possible of adult healthy individuals to some intermediate station, and increase them as much as possible for some years.

2. As soon as the stock has been kept a sufficient time to pass through all the ordinary extremes of cli-

mate, a number of the hardest may be removed to the more remote station, and the same process gone through, giving protection if necessary while the stock is being increased, but as soon as a large number of healthy individuals are produced, subjecting them to all the vicissitudes of the climate.

Acclimatisation of Man.—On this subject we have, unfortunately, very little direct or accurate information. The general laws of heredity and variation have been proved to apply to man as well as to animals and plants; and numerous facts in the distribution of races show that man must, in remote ages at least, have been capable of constitutional adaptation to climate. If the human race constitutes a single species, then the mere fact that man now inhabits every region, and is in each case constitutionally adapted to the climate, proves that acclimatisation has occurred. But we have the same phenomenon in single varieties of man, such as the American, which inhabits alike the frozen wastes of Hudson's Bay and Terra del Fuego, and the hottest regions of the tropics, — the low equatorial valleys and the lofty plateaux of the Andes. No doubt a sudden transference to an extreme climate is often prejudicial to man, as it is to most animals and plants; but there is every reason to believe that, if the migration occurs step by step, man can be acclimatised to almost any part of the earth's surface in comparatively few generations. Some eminent writers have denied this. Sir Ronald Martin, from a consideration of the effects of the climate of India on Europeans and their offspring, believes that there is no such thing as acclimatisation. Dr. Hunt, in a report to the British Association in 1861, argues that "time is no agent," and — "if there is no sign of acclimatisation in one generation, there is no such process." But he entirely ignores the effect of favorable variations, as well as the direct influence of climate acting on the organization from infancy.

Professor Waitz, in his *Introduction to Anthropology*, adduces many examples of the comparatively rapid constitutional adaptation of man to climatic conditions. Negroes, for example, who have been for three or four generations acclimatised in North America, on returning to Africa become subject to the same local diseases as other unacclimatised individuals. He well remarks, that the debility and sickening of Europeans in many tropical countries are wrongly ascribed to the climate, but are rather the consequences of indolence, sensual gratification, and an irregular mode of life. Thus the English, who cannot give up animal food and spirituous liquors, are less able to sustain the heat of the tropics than the more sober Spaniards and Portuguese.

The Jews are a good example of acclimatisation, because they have been established for many centuries in climates very different from that of their native land; they keep themselves almost wholly free from intermixture with the people around them; and they are often so populous in a country that the intermixture with Jewish immigrants from other lands cannot seriously affect the local purity of the race.

In some of the hottest parts of South America Europeans are perfectly acclimatised, and where the race is kept pure it seems to be even improved. Some very valuable notes on this subject have been furnished to the present writer by the well-known botanist, Dr. Richard Spruce, who resided many years in South America, but who has hitherto been prevented by ill health from giving to the world the results of his researches.

"The white inhabitants of Guayaquil (lat. $2^{\circ} 13' S.$) are kept pure by careful selection. The slightest tincture of red or black blood bars entry into any of the old families who are descendants of Spaniards from the Provincias Vascongadas, or those bordering the Bay of

Biscay, where the morals are perhaps the purest (as regards the intercourse of the sexes) of any in Europe, and where for a girl, even of the poorest class, to have a child before marriage is the rarest thing possible. The consequence of this careful breeding is, the women of Guayaquil are considered (and justly) the finest along the whole Pacific coast."

"The oldest Christian town in Peru is Piura (lat. $5^{\circ} S.$), which was founded by Pizarro himself. The climate is very hot, especially in the three or four months following the southern solstice. In March 1843 the temperature only once fell as low as 83° , during the whole month, the usual lowest night temperature being 85° . Yet people of all colors find it very healthy, and the whites are very prolific."

The following example of divergent acclimatisation of the same race to hot and cold zones is very interesting, and will conclude our extracts from Dr. Spruce's valuable notes:—

"One of the most singular cases connected with this subject that have fallen under my own observation, is the difficulty, or apparent impossibility, of acclimatising the Red Indian in a certain zone of the Andes.

"Now, there is a zone of the equatorial Andes, ranging between about 4000 and 6000 feet altitude, where the very best flavored coffee is grown, where cane is less luxuriant but more saccharine than in the plains, and which is therefore very desirable to cultivate, but where the red man sickens and dies.

"In what is now the republic of Ecuador, the only peopled portions are the central valley, between the two ridges of the Andes—height 7000 to 12,000 feet—and the hot plain at their western base; nor do the wooded slopes appear to have been inhabited, except by scattered savage hordes, even in the time of the Incas. The Indians of the highlands are the descendants of others who have inhabited that region exclusively for untold ages; and a similar affirmation may be made of the Indians of the plain. Now, there is little doubt that the progenitors of both these sections came from a temperate region (in North America); so that here we have one moiety acclimatised to endure extreme heat, and the other extreme cold; and at this day exposure of either to the opposite extreme (or even, as we have seen, to the climate of an intermediate zone) is always pernicious and often fatal. But if this great difference has been brought about in the red man, might not the same have happened to the white man?"

The observations of Dr. Spruce are of themselves almost conclusive as to the possibility of Europeans becoming acclimatised in the tropics; and if it is objected that this evidence applies only to the dark-haired southern races, we are fortunately able to point to facts, almost equally well authenticated and conclusive, in the case of one of the typical Germanic races. At the Cape of Good Hope the Dutch have been settled and nearly isolated for about 200 years, and have kept themselves almost or quite free from native intermixture. They marry young, and have large families. The population, according to a census taken in 1798, was under 22,000. In 1865 it was near 182,000, the majority being (according to the *Statesman's Year Book* for 1873) of "Dutch, German, or French origin, mostly descendants of original settlers." In the Moluccas, where the Dutch have had settlements for nearly 250 years, some of the inhabitants trace their descent to early immigrants; and these, as well as most of the people of Dutch descent in the East, are quite as fair as their European ancestors, enjoy excellent health, and are very prolific. In addition to these examples, it may be maintained that the rapid increase of English-speaking populations in the United States and in Australia, only a comparatively small por

tion of which can be due to direct immigration, is far from supporting the view of Dr. Knox, that Europeans cannot permanently maintain themselves in those countries. Mr. Brace expressly denies that the American physique has degenerated from the English type. He asserts that manufacturers and others find that, "for labors requiring the utmost physical endurance and muscular power, such as iron-puddling and lumbering in the forests and on the streams, and pioneer work, foreigners are never so suitable as native Americans."

ACCOLADE, a ceremony anciently used in conferring knighthood; but whether it was an embrace or a slight blow on the neck or cheek, is not agreed. Both these customs appear to be of great antiquity.

ACCOLTI, BENEDICT, was born in 1415 at Arezzo, in Tuscany, of a noble family, several members of which were distinguished, like himself, for their attainments in law. He was for some time professor of jurisprudence in the University of Florence, and, on the death of the celebrated Poggio, in 1459, became chancellor of the Florentine Republic. He died in 1466.

ACCOLTI, BERNARD (1465-1535), son of the preceding, known in his own day as *l'Unico Aretino*, acquired great fame as a reciter of impromptu verse.

ACCOLTI, PIETRO, brother of the preceding, was born in Florence in 1455, and died there in 1549.

ACCOMMODATION, a term used in Biblical interpretation to denote the presentation of a truth not absolutely as it is in itself, but relatively, or under some modification, with a view of suiting it either to some other truth or to the persons addressed.

ACCOMMODATION, in commerce, denotes generally temporary pecuniary aid given by one trader to another, or by a banker to his customers, but it is used more particularly to describe that class of bills of exchange which represents no actual exchange of real value between the parties.

ACCORAMBONI, VITTORIA, an Italian lady remarkable for her extraordinary beauty and her tragic history. Her contemporaries regarded her as the most captivating woman that had ever been seen in Italy. She was sought in marriage by many of the nobility, finally marrying Francesco Peretti, who was assassinated in 1581, leaving his vast estates to his wife, who was in turn assassinated in 1585 by a relative.

ACCORDION (from the French *accord*), a small musical instrument in the shape of a bellows, which produces sounds by the action of wind on metallic reeds of various sizes.

ACCORSO (in Latin *Accursius*), FRANCIS, an eminent lawyer, born at Florence about 1182. After practicing for some time in his native city, he was appointed professor at Bologna, where he had great success as a teacher. He undertook the great work of arranging into one body the almost innumerable comments and remarks upon the Code, the Institutes, and Digests, the confused dispersion of which among the works of different writers caused much obscurity and contradiction. He died at Bologna in 1260.

ACCORSO (or ACCURSUS), MARIANGELO, a learned and ingenious critic, was born at Aquila, in the kingdom of Naples, about 1490. He was a great favorite with Charles V., at whose court he resided for thirty-three years, and by whom he was employed on various foreign missions. To a perfect knowledge of Greek and Latin he added an intimate acquaintance with several modern languages. He died about 1574.

ACCOUNT, a Stock Exchange term: *e. g.*, "*To Buy or Sell for the Account*," etc. The word has different, though kindred, significations, all derived from the making up and settling of accounts on particular days, in which stricter sense the word "Settlement" is more

specially used. In America, each stock exchange has its own particular rules, and the times of settling accounts are left entirely to arrangement between brokers. All kinds of deals are made, and no one statement can cover the entire ground.

In English and Indian Government securities, the settlements are monthly, and for foreign, railway, and other securities, generally speaking, they are fortnightly.

The account in consols, or other English Government securities, or in the securities of the Government of India, or in Bank of England stock, or other stocks transferable at the Bank of England, extends over a month, the settlement being monthly, and in them the committee of the stock exchange does not take cognizance of any bargain for a future account, if it shall have been effected more than eight days previously to the close of the existing account.

The account in securities to bearer, and, with the above exceptions, in registered securities also, extends over a period of from twelve to nineteen days.

ACCOUNTANT, earlier form ACCOMPTANT, in the most general sense, is a person skilled in accounts.

ACCOUNTANT-GENERAL, an officer in the English Court of Chancery, who receives all moneys lodged in court, and by whom they are deposited in bank and disbursed.

ACCRA, or ACRA, a town, or rather a collection of forts, in a territory of the same name, on the Gold Coast of Africa, about seventy-five miles east of Cape Coast Castle. It belongs to Great Britain.

ACCRINGTON, an important manufacturing town of England, in Lancashire, lies on the banks of a stream called the Hindburn, in a deep valley, nineteen miles north from Manchester. It has increased rapidly in recent years, and is the center of the Manchester cotton-printing trade. Population (1889), 35,000.

ACCUM, FREDERICK, chemist, born at Bückeburg, in 1769, went to London in 1793, and was appointed teacher of chemistry and mineralogy at the Surrey Institution in 1801. He died in Berlin in 1838.

ACCUMULATOR is (1) a part of a hydraulic lift, whereby constant pressure is obtained; (2) a part of an electric apparatus by which a current is stored for future use.

ACE, the received name for the single point on cards or dice—the unit.

ACEPHALA, a name sometimes given to a section of the molluscan animals, which are divided into *encephala* and *acephala*, according as they have or want a distinctly differentiated head.

ACEPHAL, a term applied to several sects as having no head or leader; and in particular to a sect that separated itself, in the end of the 5th century, from the rule of the patriarchs of Alexandria, and remained without king or bishop for more than 300 years.

ACEPHAL was also the name given to the levelers in the reign of Henry I., who are said to have been so poor as to have no tenements, in virtue of which they might acknowledge a superior lord.

ACEPHAL, or *Accephalus Persons*, fabulous monsters, described by some ancient naturalists and geographers as having no heads.

ACER. See MAPLE.

ACERBI, GIUSEPPE (JOSEPH), an Italian traveler, born at Castel-Goffredo, near Mantua, on the 3d May, 1773. After traveling in Europe and Africa he took up his residence in his native place, where he occupied himself with natural science till his death, in August, 1846.

ACERNUS, the Latinized name by which SEBASTIAN FABIAN KLONOWICZ, a celebrated Polish poet, is gen-

ally known, was born at Salmierzyce in 1551, and died at Lublin in 1608.

ACERRA, in *Antiquity*, a little box or pot, wherein were put the incense and perfumes to be burned on the altars of the gods, and before the dead.

The name *acerra* was also applied to an altar erected among the Romans, near the bed of a person recently deceased, on which his friends offered incense daily till his burial.

ACERRA, a town of Italy, in the province of Terra di Lavoro, situated on the river Agno, 7 miles N.E. of Naples, with a population (1890) of 16,000.

ACETAL, one of the products of the slow oxidation of alcohol under the influence of finely divided platinum or of chlorine, or of diluted sulphuric acid and peroxide of manganese.

ACETIC ACID, one of the most important organic acids. It occurs naturally in the juice of many plants, and in certain animal secretions, but is generally obtained, on the large scale, from the oxidation of spoiled wines, or from the destructive distillation of wood. For its properties, etc., see any work on chemistry.

ACHAIA, in *Ancient Geography*, a name differently applied at different periods. In the earliest times the name was borne by a small district in the south of Thessaly, and was the first residence of the Achæans. When Greece was subdued by the Romans, *Achaia* was the name given to the most southerly of the provinces into which they divided the country, and included the *Peloponnesus*, the greater part of Greece Proper, and the islands.

Achæans and the Achæan League.—The early inhabitants of Achaia were called *Achæans*. The name was given also in those times to some of the tribes occupying the eastern portions of the Peloponnesus, particularly *Argos* and *Sparta*. Afterwards the inhabitants of Achaia Propria appropriated the name. This republic was not considerable, in early times, as regards either the number of its troops, its wealth, or the extent of its territory, but was famed for its heroic virtues. The Achæan commonwealth consisted of twelve inconsiderable towns in Peloponnesus. About 280 years before Christ the republic of the Achæans recovered its old institutions and unanimity. This was the renewal of the ancient confederation, which subsequently became so famous under the name of the *ACHÆAN LEAGUE*.

ACHAN, the son of Carmi, of the tribe of Judah, at the taking of Jericho concealed a considerable amount of plunder, contrary to the command of God, for which offense he was stoned to death.

ACHARD, FRANZ CARL, a Prussian chemist, born at Berlin on the 28th April, 1753, was the first to turn Marggraf's discovery of the presence of sugar in beet-root to commercial account. He died in 1821.

ACHARIUS, ERIK, a Swedish physician and botanist, born at Gefle in 1757. He was educated at Upsal, where Linnæus was one of his teachers. He confined his researches and writings almost entirely to the cryptogamous plants. He died in 1819.

ACHATES, the faithful friend and companion of Æneas, celebrated in Virgil's *Æneid* as *fidus Achates*.

ACHEEN. See *ACHIN*.

ACHELOUS, the largest river in Greece, rises in Mount Pindus, and, dividing Ætolia from Acarnania, falls into the Ionian Sea. The river is now called *Aspro Potamo*.

ACHÆMENIDES, a dynasty of Ancient Persia, from which sprang Cyrus the Great. See Vol. III, page 1889.

ACHENWALL, GOTTFRIED, a German writer, celebrated as having formulated and developed the science of statistics. He was born in 1719, and died in 1772.

ACHERON, in *Classical Mythology*, the son of Ceres, who, for supplying the Titans with drink when they were in contest with Jupiter, was turned into a river of Hades, over which departed souls were ferried on their way to Elysium.

ACHILL, or "Eagle" Island, off the west coast of Ireland, forms part of the county of Mayo.

ACHILLES, the son of Peleus and Thetis, the beautiful nereid, who, after giving birth to the hero, returned to her life beneath the sea. He was educated by the centaur Chiron until he reached his ninth year, when he was placed (disguised as a girl to shield him from danger) among the daughters of Lycomedes. His mother used various means to render him invulnerable, dipping him into the river Styx, which protected the parts it touched. All portions of his body were enveloped by the water except the heel, by which his mother held him during the operation of dipping. This left his heel vulnerable, and, after he had slain Hector before Troy, he was himself slain by an arrow from the bow of Paris striking his heel.

ACHILLES TATIUS, a Greek writer, born at Alexandria. The precise time when he flourished is uncertain, but it cannot have been earlier than the 5th century, as in his principal work he evidently imitates Heliodorus.

ACHILLES TENDON, the tendon which attaches the soleus and gastrocnemius muscles of the calf of the leg to the heel-bone. It is of great strength, and capable of resisting a tension strain equal to a weight of a thousand pounds, but is occasionally ruptured.

ACHILLINI, ALEXANDER (1463-1512), a native of Bologna, was celebrated as a lecturer both in medicine and in philosophy, and was styled the second Aristotle.

ÁCHÍN, a town and also a state of Northern Sumatra; the one state of that island which has been powerful at any time since the discovery of the Cape route to the East, and the only one that still remains independent of the Dutch, though that independence is now menaced.

The present limits of Áchín supremacy in Sumatra are reckoned to be, on the east coast the River Tamiang, in about 4° 25' N. lat., which forms the frontier of territories tributary to Siák; and on the west coast a line in about 2° 48' N., the frontier of Trumon, a small modern state lying between Áchín and the Dutch government of Padang. Even within these limits the actual power of Áchín is precarious, and the interior boundary can be laid down only from conjecture. This interior country is totally unexplored. It is believed to be inhabited by tribes kindred to the Battas, that remarkable race of anthropophagi who adjoin on the south. The whole area of Áchín territory, defined to the best of our ability, will contain about 16,400 English square miles. A rate of 20 per square mile, perhaps somewhat too large on an average, gives a probable population of 328,000.

The production of rice and pepper forms the chief industry of the Áchín territory. From Pedir and other ports on the north coast large quantities of betel-nut are exported to continental India, Burmah, and to Penang for China. Some pepper is got from Pedir, but the chief export is from a number of small ports and anchorages on the west coast, where vessels go from port to port making up a cargo. Áchín ponies are of good repute, and are exported. Minor articles of export are sulphur, iron, sappan-wood, gutta-percha, dammer, rattans, bamboos, benzoin, and camphor from the interior forests. The camphor is that from the *Dryobalanops camphora*, for which so high a price is paid in China, and the whole goes thither, the bulk of that

whole being, however, extremely small. Very little silk is now produced, but in the 16th century the quantity seems to have been considerable.

The chief attraction to the considerable trade that existed at Áchín two centuries ago must have been gold.

The great repute of Áchín at one time as a place of trade is shown by the fact, that to this port the first Dutch (1599) and first English (1602) commercial ventures to the Indies were directed.

The French made one great effort under Beaulieu (1621) to establish relations with Áchín, but nothing came of it.

Still the foreign trade of Áchín, though subject to spasmodic interruptions, was important. Dampier and others speak of the number of foreign merchants settled there, — English, Dutch, Danes, Portuguese, Chinese, Banyans from Guzerat, &c.

The Áchinese are not identical with the Malays proper either in aspect or language. They are said to be taller, handsomer, and darker, as if with a mixture of blood from India proper. Their language is little known; but though it has now absorbed much Malay, the original part of it is said to have characteristics connecting it both with the Batta and with the Indo-Chinese tongues.

The name of the state is properly *Ácheh*. This the Portuguese made into *Achem*; whilst we, with the Dutch, learned to call it *Áchín*. The last appears to have been a Persian or Indian form, suggested by jingling analogy with Máchín (China).

The town itself lies very near the north-west extremity of Sumatra, known in charts as Áchín Head. Here a girdle of ten or twelve small islands affords protection to the anchorage.

The valley or alluvial plain in which Áchín lies is low, and subject to partial inundation; but it is shut in at a short distance from the town, on the three landed sides, by hills. It is highly cultivated, and abounds in small villages and kampongs, with white mosques interspersed.

The court of Áchín, in the 17th century, maintained a good deal of pomp; and, according to Beaulieu, the king had always 900 elephants. These animals, though found throughout Sumatra, are now no longer tamed or kept.

Hostilities with the Portuguese began from the time of the first independent king of Áchín; and they had little remission till the power of Portugal fell with the loss of Malacca (1641). Not less than ten times before that event were armaments despatched from Áchín to reduce Malacca, and more than once its garrison was very hard pressed.

A Dutch force landed at Áchín in April 1873, and attacked the palace. It was defeated with considerable loss, including that of the general (Köhler). The approach of the south-west monsoon was considered to preclude the immediate renewal of the attempt, but hostilities were resumed, and Áchín fell in January 1874.

ACHMET, or AHMED, the name of three emperors or sultans of Turkey, the first of the name reigning from 1603 to 1617, the second from 1691 to 1695, and the third from 1703 to 1736.

ACHRAY, a small picturesque lake in Perthshire, near Loch Katrine, twenty miles west of Stirling, Scotland, which has obtained notoriety from Scott's allusion to it in the *Lady of the Lake*.

ACHROMATIC GLASSES are so named from being specially constructed with a view to prevent the confusion of colors and distortion of images that result from the use of lenses in optical instruments.

ACI REALE, a city and seaport of Sicily, in the Italian province of Catania, near the base of Mount Etna. Aci Reale has a population of 24,151.

ACID, a general term in chemistry, applied to a group of compound substances, possessing certain very distinctive characteristics.

The majority of acids possess the following *contingent* properties:—

1. When applied to the tongue, they excite that sensation which is called *sour* or *acid*.

2. They change the blue colors of vegetables to a red. The vegetable blues employed for this purpose are generally tincture of litmus and syrup of violets or of radishes, which have obtained the name of *re-agents* or *tests*. If these colors have been previously converted to a *green* by alkalies, the acids restore them.

All these secondary properties are variable; and, if we attempted to base a definition on any one of them, many important acids would be excluded. The full importance of the definition of an acid will be learned only by a study of the science of chemistry.

ACIDALIUS, VALENS, a very distinguished scholar and critic, born in 1567 at Wittstock, in Brandenburg; died in 1595.

ACINACES, an ancient Persian sword, short and straight, and worn on the right side, or sometimes in front of the body, as shown in the bas-reliefs found at Persepolis.

ACIS, in *Mythology*, the son of Faunus and the nymph Symæthis, was a beautiful shepherd of Sicily, who being beloved by Galatea, Polyphemus the giant was so enraged that he crushed his rival with a rock, and his blood, gushing forth from under the rock, was metamorphosed into the river bearing his name.

ACKERMANN, JOHN CHRISTIAN GOTTLIEB, a learned physician and professor of medicine, born at Zeulenroda, in Upper Saxony, in 1756. In 1786 he became professor of medicine at the university of Altorf, in Franconia, occupying first the chair of chemistry, and then, from 1794 till his death in 1801, that of pathology and therapeutics.

ACEMETÆ (sleepless), an order of monks which celebrated divine service night and day, being for that purpose divided into three relays or watches.

ACOLYTE (an attendant), one of a minor order of clergy in the ancient church, ranking next to the sub-deacon. The name and office still exist in the church.

ACONCAGUA, a province of Chile, South America, is about 100 miles long by 40 miles wide, and lies between 31° 30' and 33° 20' S. lat., and 70° and 71° 30' W. long., between the provinces of Valparaiso and Santiago on the N., and Coquimbo on the S. Population, 134,178.

ACONITE, ACONITUM, a genus of plants commonly known as Aconite, Monkshood, Friar's Cap, or Helmet flower, and embracing about 18 species, chiefly natives of the mountainous parts of the northern hemisphere. They are distinguished by having one of the five blue or yellow colored sepals in the form of a helmet; hence the English name. Many species of Aconite are cultivated in gardens, some having blue and others yellow flowers. *Aconitum Lycotomum*, Wolfsbane, is a yellow-flowered species common on the Alps of Switzerland. One species, *Aconitum heterophyllum*, found in the East Indies, and called Butees, has tonic properties in its roots. The roots of *Aconitum jerox* supply the famous Indian (Nipal) poison called Bikh, Bish, or Nabee. The active principle, aconitine, is useful in allaying violent heart action and fever, and as a remedy for neuralgia. It is usually administered in doses of 1 to 5 drops of the tincture of leaves or roots of *Aconitum Lycotomum*.

ACONTIUS, the Latinised form of the name of GIACOMO ACONCIO, a philosopher, juriconsult, engineer and theologian, born at Trent on the 7th September 1492. He embraced the reformed religion, and, after having taken refuge for a while in Switzerland and Strassburg, he went to England about 1558. He died in London about the year 1566.

ACORUS, a genus of monocotyledonous plants, belonging to the natural order Aroidæ, and the sub-order Orontiaceæ. *Acorus Calamus*, sweet-sedge, or sweet-flag, is a native of Britain.

ACOSTA, CHRISTOVAL D', a Portuguese naturalist, born at Mozambique in the early part of the 16th century. On a voyage to Asia he was taken captive by pirates, who exacted from him a very large ransom. He died in 1580.

ACOSTA, JOSEPH D', a celebrated Spanish author, was born at Medina del Campo about the year 1539. In 1571 he went to Peru as a provincial of the Jesuits; and, after remaining there for seventeen years, he returned to his native country, where he became, in succession, visitor for his order of Aragon and Andalusia, superior of Valladolid and rector of the university of Salamanca, in which city he died in February 1600. About ten years before his death he published, at Seville, his valuable *Historia Natural y Moral de las Indias*, part of which had previously appeared in Latin, with the title *De Natura Novi Orbis, libri duo*.

ACOSTA, URIEL D', a Portuguese of noble family, was born at Oporto towards the close of the 16th century. His father being a Jewish convert to Christianity, he was brought up in the Roman Catholic faith, and strictly observed the rites of the church till the course of his inquiries led him, after much painful doubt, to abandon the religion of his youth for Judaism. Having recanted his heresies, he was re-admitted after an excommunication of fifteen years, but was soon excommunicated a second time. After seven years of miserable exclusion, he once more sought admission; and, on passing through a humiliating penance, was again received.

ACOTYLEDONES, the name given to one of the Classes of the Natural System of Botany, embracing flowerless plants, such as ferns, lycopods, horse-tails, mosses, liverworts, lichens, sea-weeds, and mushrooms. The name is derived from the character of the embryo, which has no cotyledon. In the article BOTANY these plants are noticed in Vol. II., on pages 1053 and 1054.

ACOUSTICS (to hear) is that branch of Natural Philosophy which treats of the nature of sound, and the laws of its production and propagation, in so far as these depend on physical principles. The description of the mechanism of the organ of voice and of the ear, and the difficult questions connected with the processes by which, when sound reaches the drum of the ear, it is transmitted to the brain, must be dealt with in separate articles of this work. It is to the physical part of the science of acoustics that the present article is restricted.

PART I.

General notions as to Vibrations, Waves, &c.

We may easily satisfy ourselves that, in every instance in which the sensation of sound is excited, the body, whence the sound proceeds, must have been thrown, by a blow or other means, into a state of agitation or tremor, implying the existence of a vibratory motion, or motion to and fro, of the particles of which it consists.

It is, moreover, essential, in order that the ear may be affected by a sounding body, that there be interposed between it and the ear one or more intermediate bodies (*media*), themselves capable of molecular vibration,

which shall receive such motion from the source of sound, and transmit it to the external parts of the ear, and especially to the *membrana tympani* or *drum* of the ear. This statement is confirmed by the well-known effect of stopping the ear with soft cotton, or other substance possessing little elasticity.

Inasmuch, then, as sound necessarily implies the existence in the sounding body, in the air, &c., and (we may add) in the ear itself, of vibratory motion of the particles of the various media concerned in the phenomenon, a general reference to the laws of such motion is essential to a right understanding of the principles of acoustics.

The most familiar instance of this kind of motion is afforded by the pendulum, a small heavy ball, for instance, attached to a fine string, which is fixed at its other end. There is but one position in which the ball will remain at rest, viz., when the string is vertical, there being then equilibrium between the two forces acting on the body, the tension of the string and the earth's attractive force or gravity.

The particle is a solitary particle acted on by external forces. But, in acoustics, we have to do with the motion of particles forming a connected system or medium, in which the forces to be considered arise from the mutual actions of the particles. These forces are in equilibrium with each other when the particles occupy certain relative positions. But, if any new or disturbing force act for a short time on any one or more of the particles, so as to cause a mutual approach or a mutual recession, on the removal of the disturbing force, the disturbed particles will, if the body be *elastic*, forthwith move towards their respective positions of equilibrium. Hence arises a vibratory motion to and fro of each about a given point, analogous to that of a pendulum, the velocity at that point being always a maximum, alternately in opposite directions.

PART II.

Velocity of propagation of waves of longitudinal disturbances through any elastic medium.

Sir Isaac Newton was the first who attempted to determine, on theoretical grounds, the velocity of sound in air and other fluids. The formula obtained by him gives, however, a numerical value, as regards air, falling far short of the result derived from actual experiment; and it was not till long afterwards, when Laplace took up the question, that complete coincidence was arrived at between theory and observation.

The experimental determination of the velocity of sound in air has been carried out by ascertaining accurately the time intervening between the flash and report of a gun as observed at a given distance, and dividing the distance by the time. A discussion of the many experiments conducted on this principle in various countries and at various periods, by Van Der Kolk (*Lond. and Edin. Phil. Mag.*, July 1865), assigns to the velocity of sound in dry air at 32° Fahr., 1091 ft. 8 in. per second, with a probable error of = 3.7 ft.; and still more recently (in 1871) Mr. Stone, the Astronomer Royal at the Cape of Good Hope, has found 1090.6 as the result of careful experiments by himself there. The coincidence of these numbers with that we have already obtained theoretically sufficiently establishes the general accuracy of the theory.

Biot, about 50 years ago, availed himself of the great difference in the velocity of the propagation of sound through metals and through air, to determine the ratio of the one velocity to the other. A bell placed near one extremity of a train of iron pipes forming a joint length of upwards of 3000 feet, being struck at the same instant as the same extremity of the pipe, a person placed at the

other extremity heard first the sound of the blow on the pipe, conveyed through the iron, and then, after an interval of time, which was noted as accurately as possible, the sound of the bell transmitted through the air. The result was a velocity for the iron of 10.5 times that in air. Similar experiments on iron telegraph wire, made more recently near Paris by Wertheim and Brequet, had led to an almost identical number. Unfortunately, owing to the metal in these experiments not forming a continuous whole, and to other causes, the results obtained, which fall short of those otherwise found, cannot be accepted as correct.

It is a well known fact that, in all but very exceptional cases, the loudness of any sound is less as the distance increases between the source of sound and the ear. The law according to which this decay takes place is the same as obtains in other natural phenomena, viz., that in an unlimited and uniform medium the loudness or intensity of the sound proceeding from a very small sounding body (strictly speaking, a point) varies inversely as the square of the distance. Where the vibrations are transmitted through a wire by means of electricity, as in the telephone, the decrease in intensity is very small for very considerable distances; and experiment shows that where the medium of transmission is *continuous* and not pieced or coupled the distance can be greatly increased, without diminution of volume in the sound. [See TELEPHONE.]

In order to verify the above law when the atmosphere forms the intervening medium, it would be necessary to test it at a considerable elevation above the earth's surface, the ear and the source of the sound being separated by air of constant density. As the density of the air diminishes, we should then find that the loudness of the sound at a given distance would decrease, as is the case with a sound produced in a partial vacuum. This arises from the decrease of the quantity of matter impinging on the ear, and the consequent diminution of its *vis viva*. The decay of sound due to this cause is observable in the rarefied air of high mountainous regions. De Saussure, the celebrated Alpine traveler, mentions that the report of a pistol at a great elevation appeared no louder than would a small cracker at a lower level.

But it is to be remarked that, according to Poisson, when air-strata of different densities are interposed between the source of sound and the ear placed at a given distance, the intensity depends only on the density of the air at the source itself; whence it follows that the sounds proceeding from the surface of the earth may be heard at equal distances as distinctly by a person in a floating balloon as by one situated on the surface itself; whereas any noise originating in the balloon would be heard at the surface as faintly as if the ear were placed in the rarefied air on a level with the balloon.

PART III.

Reflection and Refraction of Sound.

When a wave of sound traveling through one medium meets a second medium of a different kind, the vibrations of its own particles are communicated to the particles of the new medium, so that a wave is excited in the latter, and is propagated through it with a velocity dependent on the density and elasticity of the second medium, and therefore differing in general from the previous velocity. The direction, too, in which the new wave travels is different from the previous one. This change of direction is termed *refraction*, and takes place according to the same laws as does the refraction of light, viz.: (1) The new direction or *refracted ray* lies always in the *plane of incidence*, or

plane which contains the incipient ray (*i.e.*, the direction of the wave in the first medium), and the normal to the surface separating the two media, at the point in which the incident ray meets it; (2) the *sine* of the angle between the normal and the incident ray bears to the *sine* of the angle between the normal and the refracted ray, a ratio which is constant for the same pair of media.

As light is concentrated into a focus by a convex glass (for which the velocity of light is less than for the air), so sound ought to be made to converge by passing through a convex lens formed of *carbonic acid* gas. On the other hand, to produce convergence with water or hydrogen gas, in both which the velocity of sound exceeds its rate in air, the lens ought to be *concave*. The practicability of focusing the sound waves has been demonstrated by the microphone, in which it is done with such intense effect that a "fly can be heard crawling on the wall." [See MICROPHONE.]

When a wave of sound falls on a surface separating two media, in addition to the refracted wave transmitted into the new medium, there is also a fresh wave formed in the new medium, and traveling in it in a different direction, but, of course, with the same velocity. This *reflected* wave is subject to the same laws as regulate the reflection of light, viz., (1) the coincidence of the planes of incidence and of reflection, and (2) the equality of the angles of incidence and reflection, that is, of the angles made by the incident and reflected rays with the normal.

On principles of repeated reflection may be explained the well-known fact that sounds may be conveyed to great distances with remarkably slight loss of intensity, on a level piece of ground or smooth sheet of water or ice, and still more so in pipes, chimneys, tunnels, &c. Thus, in one of Captain Parry's Polar expeditions, a conversation was on one occasion carried on, at a distance of $1\frac{1}{4}$ mile, between two individuals separated by a frozen sheet of water. M. Biot heard distinctly from one end of a train of pipes $\frac{3}{4}$ of a mile long, previously referred to, a low whisper proceeding from the opposite end.

The prolonged roll of thunder, with its manifold varieties, is partly to be ascribed to reflection by mountains, clouds, &c.; but is mainly accounted for on a different acoustic principle, viz., the comparatively low rate of transmission of sound through air, as was first shown by Dr. Hooke at the close of the 17th century. The explanation will be more easily understood by adverting to the case of a volley fired by a long line of troops. A person situated at a point in that line *produced*, will first, it is evident, hear the report of the nearest musket, followed by that of the one following, and so down to the last one in the line, which will close the prolonged roll thus reaching the ear; and as such single report will appear to him less intense according as it proceeds from a greater distance, the roll of the musketry thus heard will be one of gradually decreasing loudness. But if he were to place himself at a relatively great distance right opposite to the centre of the line, the separate reports from each of the two wings would reach him nearly at the same moment, and hence the sound of the volley would now approach more nearly to that of a single loud crash. If the line of soldiers formed an arc of a circle having its centre in his position, then the distance gone over by the separate reports being equal, they would reach his ear at the same absolute instant of time, and with exactly equal intensities; and the effect produced would be strictly the same as that of a single explosion, equal in violence to the sum of all separate discharges, occurring at the same distance. It is easy to see that by varying the form of the line of troops and the position of the observer, the

sonorous effect will be diversified to any extent desired. If, then, we keep in view the great diversity of form exhibited by lightning-flashes, which may be regarded as being lines, at the points of which are generated explosions at the same instant of time, and the variety of distance and relative position at which the observer may be placed, we shall feel no difficulty in accounting for all those acoustic phenomena of thunder to which Hooke's theory is applicable.

PART IV.

The Principles of Musical Harmony.

A few words on the subject of *musical harmony* must be introduced here for the immediate purposes of this article, further details being reserved for the special article on that subject.

Sounds in general exhibit three different qualities, so far as their effect on the ear is concerned, viz., *loudness, pitch, and timbre.*

Loudness depends, *cat. par.*, on the violence with which the vibrating portions of the ear are excited; and therefore on the *extent or amplitude* of the vibrations of the body whence the sound proceeds. Hence, after a bell has been struck, its effect on the ear gradually diminishes as its vibration becomes less and less extensive. By the theory of vibrations, loudness or intensity is measured by the *vis viva* of the vibrating particles, and is consequently proportional to the square of their maximum velocity or to the square of their maximum displacement. Helmholtz, however, in his remarkable work on the perception of tone, observes that notes differing in pitch differ also in loudness, where their *vis-viva* is the same, the higher note always exhibiting the greater intensity.

Difference of *pitch* is that which finds expression in the common terms applied to notes: *Acute, shrill, high, sharp, grave, deep, low, flat.*

Besides the three qualities above mentioned, there exists another point in which sounds may be distinguished among each other, and which, though perhaps reducible to difference of timbre, requires some special remarks, viz., that by which sounds are characterised, either as *noises* or as *musical notes*.

ACOYAPA, a town of the republic of Nicaragua, Central America, of some importance as a trade center. Population, 6,000. It is a telegraph and railroad station, and is recently improving rapidly.

ACQUI, a town of Northern Italy, in the province of Alessandria, 18 miles S.W. of the city of that name, on the left bank of the Bormida. It is a place of great antiquity; and its hot sulphur baths, which are still much frequented, were known to the Romans, who gave the place the name of *Aquæ Statiellæ*. Population, 8600.

ACRE, a measure of surface, being the principal denomination of land-measure used in Great Britain and in the United States. The word (akin to the Saxon *acer*, the German *acker*, and the Latin *ager*, a field) did not originally signify a determinate quantity of land, but any open ground.

The acre consists of 4,840 square yards. The chain with which land is measured is twenty-two yards long, and a square chain contains $22 \times 22 = 484$ yards, so that 10 square chains make an acre. The acre is divided into 4 roods; the rood into 40 perches. The old Scotch acre is larger than the English, and the Irish larger than the Scotch; 23 Scotch acres equal 29 English; $30\frac{1}{4}$ Irish equals 49 English acres.

ACRÉ, AKKA, or ST. JEAN D'ACRE, a town and seaport of Syria, and in ancient times a celebrated city. No town has experienced greater changes from political revolutions and the calamities of war. According to

some, this was the *Accho* of the Scriptures; and its great antiquity is proved by fragments of houses that have been found, consisting of that highly sun-burnt brick, with a mixture of cement and sand, which was only used in erections of the remotest ages. It is memorable in modern history for the gallantry with which it was defended in 1799 by the Turks, assisted by Sir Sydney Smith, against Bonaparte, who, after spending sixty-one days before it, was obliged to retreat. It continued to enjoy an increasing degree of prosperity till 1832. Though fettered by imposts and monopolies, it carried on a considerable foreign trade, and had resident consuls from most of the great states of Europe. On the revolt of Mehemet Ali, the Pacha of Egypt, Acre was besieged by his son, Ibrahim Pacha, in the winter of 1831-32. The siege lasted five months and twenty-one days, and, before the city was taken, its public and private buildings were mostly destroyed. Its fortifications were subsequently repaired and improved by the Egyptians, in whose hands it remained until 3d November 1840, when the town was reduced to ruins by a three hours' bombardment from the British fleet, acting as the allies of the sultan. The Turks were again put in possession of it in 1841.

Acre is situated on a low promontory, at the northern extremity of the Bay of Acre. Population, 10,000.

ACROBAT (to walk on tiptoe), a rope-dancer. Evidence exists that there were very skilful performers on the tight-rope (*funambuli*) among the ancient Romans.

ACROCERAUNIA, in *Ancient Geography*, a promontory in the N.W. of Epirus, which terminates the Montes Ceraunii, a range that runs S.E. from the promontory along the coast for a number of miles, and is supposed to have derived its name from being often struck with lightning.

ACROGENÆ is the name applied to a division of acotyledonous or cryptogamous plants, in which leaves are present along with vascular tissues.

ACROLITH, statues of a transition period in the history of plastic art, in which the trunk of the figure was of wood, and the head, hands and feet of marble.

ACRON, a celebrated physician, born at Agrigentum, in Sicily, who was contemporary with Empedocles, and must therefore have lived in the 5th century before Christ.

ACROPOLIS, a word signifying the upper town, or chief place of a city, a citadel, usually on the summit of a rock or hill.

ACROSTIC (meaning literally the extremity of a verse), is a species of poetical composition, so constructed that the initial letters of the lines, taken consecutively, form certain names or other particular words. This fancy is of considerable antiquity, one of the most remarkable examples of it being the verses cited by Lactantius and Eusebius in the 4th century, and attributed to the Erythrean sibyl, the initial letters of which form the words, "Jesus Christ, the Son of God, the Savior," with the addition, according to some, of "the cross." The arguments of the comedies of Plautus, with acrostics on the names of the respective plays, are probably of still earlier date. Sir John Davies (1570-1626) wrote twenty-six elegant *Hymns to Astræa*, each an acrostic on "Elizabetha Regina;" and Mistress Mary Fage, in *Fame's Roule*, 1637, commemorated 420 celebrities of her time in acrostic verses. The same form of composition is often to be met with in the writings of more recent versifiers. Sometimes the lines are so combined that the final letters as well as the initials are significant. Edgar Allan Poe, with characteristic ingenuity, worked two names—one of them that of Frances Sargent Osgood—into verse in such a way that the letters

of the names corresponded to the first letter of the first line, the second letter of the second, the third letter of the third, and so on. Generally speaking, acrostic verse is not of much value, and is held in slight estimation.

The name acrostic is also applied to alphabetical or "abecedarian" verses. Alphabetical verses have been constructed with every word of the successive lines beginning with the successive letters of the alphabet.

ACT, in *Dramatic Literature*, signifies one of those parts into which a play is divided to mark the change of time or place, and to give a respite to the actors and to the audience. In Greek plays there are no separate acts, the unities being strictly observed, and the action being continuous from beginning to end. If the principal actors left the stage the chorus took up the argument, and contributed an integral part of the play, though chiefly in the form of comment upon the action. In comedy the rule as to the number of acts has not been so strictly adhered to as in tragedy, a division into two acts or three acts being quite usual since the time of Molière, who first introduced it.

ACT, in *Law*, is an instrument in writing for declaring or justifying the truth of anything; in which sense records, decrees, sentences, reports, certificates, &c., are called acts.

ACT OF CONGRESS. The various legislative enactments of congress, when they have received the sanction of both houses and the approval of the president, become portions of the statutes of the United States, and take effect from the date of their approval, unless otherwise specified in the acts themselves. If the president fails to approve or veto within ten days after passage, the act becomes a law without further preliminaries. An act may originate in either house (except in the case of financial appropriations), and before its passage is termed a bill. Acts of congress require no formal publication to give them force.

ACT OF PARLIAMENT. An act of parliament may be regarded as a declaration of the legislature, enforcing certain rules of conduct, or defining rights, and conferring them upon or withholding them from certain persons or classes of persons. The collective body of such declarations constitutes the statutes of the realm or written law of the nation, in the widest sense, from Anglo-Saxon times to the present day. It is not, however, till Magna Charta, that, in a more limited constitutional sense, the statute-book is generally held to open. An act of the English parliament is complete whenever it receives the royal assent, and takes effect from that date, unless the act itself fix some other. British acts require no formal promulgation.

ACT OF SEDERUNT, in *Scotch Law*, an ordinance for regulating the forms of procedure before the Court of Session, passed by the judges in virtue of a power conferred by an act of the Scotch Parliament, 1540, c. 93.

ACTS OF THE APOSTLES, the fifth among the canonical books of the New Testament. What has to be said on this book will naturally fall under the following heads: The state of the text; the authorship; the object of the work; the date and the place of its composition.

The State of the Text.—The Acts is found in two MSS., generally assigned to the 4th century, the *Codex Sinaiticus*, in St. Petersburg, and the *Codex Vaticanus*, in Rome; in one MS., assigned to the 5th century, the *Codex Alexandrinus*, in the British Museum; in two MSS. belonging to the 6th century, the *Codex Beza*, in Cambridge, and the *Codex Laudianus*, in Oxford; and, in one of the 9th century, the *Codex Palimpsestus Porfirianus*, in St. Petersburg, with the exception of chapter first and eight verses of chapter second. Large frag-

ments are contained in a MS. of the 5th century, the *Codex Ephraemi*, in Paris. Fragments are contained in five other MSS., none of which is later than the 9th century. These are all the uncial MSS. containing the Acts or portions of it.

The MSS. in Oxford and Cambridge differ widely from the others. This is especially the case with the Cambridge MS., the *Codex Beza*, which is said to contain no less than six hundred interpolations. Scrivener, who has edited this MS. with great care, says: "While the general course of the history and the spirit of the work remain the same as in our commonly received text, we perpetually encounter long passages in *Codex Beza* which resemble that text only as a loose and explanatory paraphrase recalls the original form from which it sprung; save that there is no difference in the language in this instance, it is hardly an exaggeration of the facts to assert that Codex D [*i. e.*, *Codex Beza*] reproduces the *textus receptus* of the Acts, much in the same way that one of the Chaldee Targums does the best Hebrew of the Old Testament, so wide are the variations in the diction, so constant and inveterate the practice of expanding the narrative by means of interpolations." Scrivener here assumes that the additions of the *Codex Beza* are interpolations, and this is the opinion of nearly all critics. There is one, however, Bornemann, who thinks that the *Codex Beza* contains the original text, and that the others are mutilated. But, even supposing that we were quite sure that the additions were interpolations, the *Codex Beza* makes it more difficult to determine what the real text was. Scrivener, with good reason, supposes that the *Codex Beza* is derived from an original, which would most likely belong to the third century at the latest.

Authorship of the Work.—In treating this subject we begin with the external evidence.

The first mention of the authorship of the Acts in a well-authenticated book occurs in the treatise of Irenæus against heresies, written between the years 182 and 188 A.D. Irenæus names St. Luke as the author, as if the fact were well known and undoubted. He attributes the third Gospel to him, and calls him "a follower and disciple of apostles." The next mention occurs in the *Stromata* of Clemens Alexandrinus, written about 195 A.D., where part of St. Paul's speech to the Athenians is quoted with the words, "Even as Luke also, in the Acts of the Apostles, records Paul as saying." Origen speaks of "Luke who wrote the Gospel and the Acts," and Eusebius includes the Acts of the Apostles in his summary of the books of the New Testament. The Muratorian canon, generally assigned to the end of the second or beginning of the third century, includes the Acts of the Apostles, assigns it to St. Luke, and says he was an eye-witness of the facts recorded. There is thus unanimous testimony up to the time of Eusebius that St. Luke was the author of the Acts.

After the time of Eusebius we find statements to the effect that the Acts was little known. "The existence of this book," Chrysostom says, "is not known to many, nor the person who wrote and composed it." And Photius, in the ninth century, says, "Some maintain that it was Clement of Rome that was the writer of the Acts, others that it was Barnabas, and others that it was Luke the Evangelist."

We turn to the internal evidence. And in the very commencement we find the author giving himself out as the person who wrote the third Gospel. This claim has been almost universally acknowledged. There is a remarkable similarity in the style of both. The same peculiar modes of expression continually occur in both; and throughout both there exist continual references backward and forward, which imply the same authorship.

There are some difficulties in the way of this conclusion. Two of these deserve special notice. If we turn to the last chapter of the Gospel, we find it stated there (ver. 13) that two disciples met Jesus on the day of the resurrection, as they were going to Emmaus. Towards nightfall (ver. 29) he entered the village with them; and as he reclined with them, he became known to them, and disappeared. Whereupon "at that very hour" (ver. 33) they rose up and returned to Jerusalem. They found the eleven assembled, and told them what had happened. "While they were saying these things, he himself stood in the midst of them" (ver. 36). The apostles gave him a piece of fish, and he ate it. "But he said to them" (ver. 44), so the narrative goes on, and it then relates his speech; and at ver. 50 it says, "He led them out to Bethany," and then disappeared from them. This disappearance was final; and if the words used in the Gospel make us hesitate in determining it to be his ascension, such hesitation is removed by the opening words of the Acts.

The Acts itself claims to be written by a companion of St. Paul. In chap. xvi. 10, the writer, without any previous warning, passes from the third person to the first. St. Paul had reached the Troad. There he saw a vision inviting him to go to Macedonia. "But when he saw the vision, straightway we sought to go out into Macedonia."

The Acts is divided into two distinct parts. The first deals with the church in Jerusalem, and especially narrates the actions of St. Peter. We have no external means of testing this portion of the narrative. The Acts is the only work from which information is got in regard to these events. The second part pursues the history of the apostle Paul; and here we can compare the statements made in the Acts with those made in the Epistles. Now here again we have a general harmony.

In regard to the first point, St. Paul himself says in the Epistle to the Galatians, that after his conversion straightway he held no counsel with flesh and blood, nor did he go up to Jerusalem to the apostles who were before him; but he went away to Arabia and returned to Damascus; that then after three years he went up to Jerusalem to seek for Cephas, and he remained with him fourteen days. If St. Luke's narrative of St. Paul's conversion be minutely examined, it will be perceived that not only does he not mention that St. Paul saw Jesus, but the circumstances as related scarcely permitted St. Paul to see Jesus. He was at once dazzled by the light, and fell to the ground. In this prostrate condition; with his eyes shut, he heard the voice; but at first he did not know whose it was. And when he opened his eyes, he found that he was blind.

Furthermore, the point on which St. Paul specially insists in the Epistle to the Galatians is, that he was appointed the apostle to the Gentiles, as St. Peter was to the circumcised, and that circumcision and the observance of the Jewish law were of no importance to the Christian. St. Paul's words on this point in all his letters are strong and decided. But in the Acts it is St. Peter that opens up the way for the Gentiles. In St. Peter's mouth occurs the strongest language in regard to the intolerable nature of the law. Not a word is said of the quarrel between St. Peter and St. Paul. The brethren in Antioch send St. Paul and Barnabas up to Jerusalem to ask the opinion of the apostles and elders. St. Paul awaits the decision of the apostles, and St. Paul and Barnabas carry back the decision to Antioch. And, throughout the whole of the Acts, St. Paul never stands forth as the champion of the Gentiles.

We may add to this, that while St. Luke gives a rather minute account of the sufferings of St. Peter and the

church in Jerusalem, he has not brought prominently forward the perils of St. Paul. St. Paul enumerates some of his sufferings in the second Epistle to the Corinthians (chap. xi. 23-28). St. Luke has omitted a great number of these. Thus, for instance, St. Paul mentions that he was thrice shipwrecked. St. Luke does not notice one of these shipwrecks, that recorded in the Acts having taken place after the Epistles to the Corinthians were written.

St. Luke occasionally alludes, in the Acts, to events which took place outside of the church. We can test his accuracy in recording these events by comparing his narrative with the narratives of historians who treat of the same period. These historians are Josephus, Tacitus, and Suetonius. Now, here again we find that the accounts in the Acts generally agree.

The second case relates to the Egyptian mentioned in the question of the tribune to St. Paul, in Acts xxi. 38, "You are not then the Egyptian who, some time ago, made a disturbance, and led into the wilderness the four thousand of the sicarii?" Josephus mentions this Egyptian, both in his *Antiquities* (xx. 8, 6) and in the *Jewish War* (ii. 13, 5). In the *Jewish War* (ii. 13, 3), Josephus describes the sicarii, and then passes on, after a short section, to the Egyptian. He states that he collected thirty thousand people, led them out of the wilderness "to the mount called the Mount of Olives, which," he says (*Ant.* xx. 8, 6) in words similar to those in Acts i. 12, "lies opposite to the city five furlongs distant." On this Felix attacked him, killed some, captured others, and scattered the band. The Egyptian, however, escaped with some followers. Hence the question in the Acts. There are some striking resemblances between the words used by both writers. The numbers differ; but St. Luke gives the numbers of the sicarii, Josephus the numbers of the entire multitude led astray.

The third case is the one which has attracted most attention. In the speech which Gamaliel delivers, in Acts v. 35-39, it is said, "Some time before this, Theudas rose up, saying that he was some one, to whom a number of about four hundred men attached themselves, who was cut off, and all who followed him were broken up and came to nought. After him rose up Judas the Galilean, in the days of the registration, and he took away people after him; and he also perished, and all that followed him were scattered."

Not the least important of the questions which influence critics in determining the authorship of the Acts is that of miracles. Most of those who think that miracles are impossible, come to the conclusion that the narratives containing them are legendary, and accordingly they maintain that the first portion of the Acts, relating to the early church in Jerusalem and to St. Peter, is in the highest degree untrustworthy. The writer, it is maintained, had no personal knowledge of those early days, and received the stories after they had gone through a long process of transmutation. They appeal, for instance, to the account of the Pentecost, where the miracle of speaking with tongues is described. They say that it is plain, on a comparison of the Epistle to the Corinthians with the Acts, that St. Paul meant one thing by the gift of tongues, and the writer of the Acts another. And the inference is at hand that, if the writer had known St. Paul, he would have known what the gift of tongues was; and the possibility of such a mistake, it is said, implies a considerable distance from the time of the apostles and the primitive church. They point also to the curious parallelism between the miracles of St. Peter and those of St. Paul. The parallelism between the miracles of St. Peter and St. Paul is accounted for by the fact that they acted in similar

circumstances, and that actual events were at hand on which to base the parallelism. At the same time, some who believe in the possibility of miracles think that the Acts presents peculiar difficulties in this matter.

We have thus given a general summary of the questions which come up in investigating the authorship of the Acts, and of the arguments used in settling this point. The conclusions based upon this evidence are very different. Some join the traditional opinion of the church to the modern idea of inspiration, and maintain that St. Luke was the author of the work, that every discrepancy is merely apparent, and that every speech contains the real and genuine words of the speaker. Others maintain that St. Luke is the writer, and that the book is justly placed in the canon; that the narrative is, on the whole, thoroughly trustworthy, and that neither its canonicity nor credibility is affected by the existence of real discrepancies in the narrative. Others hold that St. Luke is the author, but that we have got in the book an ordinary narrative, with portions credible and portions incredible; that for the early portions of the work he had to trust mainly to his memory, dulled by distance from the scene of action and by lapse of time, and that he has given what he knew with the uncritical indifference to minute accuracy in time, circumstance, and word, which characterises all his contemporaries. Others maintain that St. Luke is the author, but that, being a credulous and unscientific Christian, he recorded indeed in honesty all that he knew, but that he was deluded in his belief of miracles, and is often inaccurate in his statement of facts. Others think that St. Luke was not the author of the work. He may have been the original author of the diary of the Apostle Paul's travels in which the "we" occurs; but the author of the Acts did not write the diary, but inserted it into his narrative after altering it for a special purpose, and the narrative was written long after St. Paul and St. Luke were dead. Others think that in the Acts we have the work of Timothy or of Silas, or of some one else. A considerable number imagine that St. Luke had different written documents before him while composing, and a very few think that the work is the work of more than one writer.

Purpose.—We have seen that the Acts of the Apostles is the work of one author possessed of no inconsiderable skill. This author evidently omits many things that he knew; he gives a short account of others of which he could have supplied accurate details, and, as in the case of St. Paul, he has brought forward one side of the character prominently, and thrown the other into the shade. What motive could have led him to act thus? What object had he in inserting what he has inserted, and omitting what he has omitted? Most of the answers given to these questions have no important bearing on the question of the authorship of the Acts. But the case is different with the answer of the Tübingen school. The Tübingen school maintains that St. Paul taught that the law was of no avail to Jew and Gentile, and that, therefore, the observance of it was unnecessary; that St. Peter and the other apostles taught that the observance of the law was necessary, and that they separated from St. Paul on this point; and that early Christians were divided into two great classes—those who held with St. Paul, or the Gentile Christians, and those who held with St. Peter, or the Jewish Christians. They further maintain that there prevailed a violent controversy between these two parties in the church, until a fusion took place towards the middle of the second half of the second century, and the Catholic Church arose. At what stage of this controversy was the Acts written? is the question they put. St. Peter, we have seen, is represented in the Acts as opening the church to

the Gentiles. St. Peter and the rest of the apostles at Jerusalem admit the Gentiles on certain gentle conditions of refraining from things offered to idols, from animals suffocated, from blood and from fornication. What could be the object of such statements but to convince the Jewish Christians that they were wrong in pertinaciously adhering to their entire exclusion of the Gentiles, or insisting on their observance of the entire law? But St. Paul is represented as observing the law, as sent forth by St. Peter and the other apostles, as going continually to the Jews first, and as appearing in the temple and coming up with collections for the Jerusalem church. Was not this also intended to reconcile the Jewish Christians to St. Paul? Then the great doctrines of St. Paul all but vanish—free grace, justification by faith alone, redemption through the blood of Christ—all that is characteristic of St. Paul disappears, except his universalism, and that is modified by the decree of the apostles, the circumcision of Timothy, and St. Paul's observance of the law. The object of all this, they affirm, must be to reconcile the Jewish party by concessions. But there is said to be also another object, of minor importance indeed, but still quite evident and falling in with the other. Throughout the Acts St. Paul is often accused of turning the world upside down and causing disturbances. The Jewish Christians may have thought that St. Paul was to blame in this matter, and that St. Paul's opinions were peculiarly calculated to stir up persecution against the Christians. The stories in the Acts were devised to convince them that they were mistaken in this supposition. On every occasion in which St. Paul is accused before magistrates, and especially Roman magistrates, he is acquitted. Gallio, the town clerk of Ephesus, Lysias, Felix and Festus, all declare that St. Paul has done nothing contrary to the law. And while the Romans thus free him from all blame, it is the Jews who are always accusing him.

Date.—There are no sure data for determining the date. Appeal used to be made to Acts viii. 26, "Unto the way which goeth down from Jerusalem to Gaza, which is desert." But most probably it is the way which is here said to be desert or lonely. But even if the word "desert" or "lonely" be applied to Gaza, we get nothing out of it. Accordingly, in the absence of data very various dates have been assigned. Some think that it was written at the time mentioned in the last chapter of Acts, when St. Paul had been two years in Rome. Some think that it must have been written after the fall of Jerusalem, as they believe that the gospel was written after that event. Irenæus thought that it was written after the death of St. Peter and St. Paul (*H. iii. 1*). Others think that St. Luke must have written it at a late period of his life, about the year 80 A.D. The Tübingen school think that it was written some time in the second century, most of them agreeing on the second or third decade of that century, about 125 A.D. They argue that a late date is proved by the nature of the purpose which occasioned the work, by the representation which it gives of the relation of the Christians to the Roman state, and by the traces of Gnosticism and of a hierarchical constitution of the church to be found in the Acts.

Place.—There is no satisfactory evidence by which to settle the place of composition. Later fathers of the church and the subscriptions of late MSS. mention Achaia, Attica, Alexandria, Macedonia, and Rome. And these places have all had their supporters in modern times. Some have also tried to show that it was written in Asia Minor, probably at Ephesus. The most likely supposition is that it was written at Rome; Zeller has argued with great plausibility for this conclusion.

There is a large literature on the subject of this article, but the most important treatises are those of Schwanbeck, Schneckenburger, Lekebusch, Zeller, Trip, Klostermann, and Ertel.

There are various other treatises claiming to be Acts of Apostles. One or two of these must have existed at an early date, though, no doubt, they have since received large interpolations. But most of them belong to a late period, and all of them are acknowledged to be apocryphal.

ACTA CONSISTORII, the edicts of the consistory or council of state of the Roman emperors. These edicts were generally expressed in such terms as these: "The august emperors, Diocletian and Maximian, in council declare, That the children of decurions shall not be exposed to wild beasts in the amphitheatre."

ACTA DIURNA, called also *Acta Populi*, *Acta Publica*, and simply *Acta* or *Diurna*, was a sort of Roman gazette, containing an authorised narrative of the transactions worthy of notice which happened at Rome—as assemblies, edicts of the magistrates, trials, executions, buildings, births, marriages, deaths, accidents, prodigies, &c. Petronius has given us an imitation specimen of the *Acta Diurna*, one or two extracts from which may be made to show their style and contents. The *Acta* were drawn up from day to day, and exposed in a public place to be read or copied by all who chose to do so. After remaining there for a reasonable time they were taken down and preserved with other public documents.

ACTA SENATUS, among the Romans, were minutes of the discussions and decisions of the senate.

ACTÆON, in *Fabulous History*, son of Aristæus and Autonoë, a famous hunter. He was torn to pieces by his own dogs.

ACTIAN GAMES, in *Roman Antiquity*, solemn games instituted by Augustus, in memory of his victory over Antony at Actium. See ACTIUM.

ACTINIA, a genus of coelenterate animals, of which the sea-anemone is the type. See ACTINOZOA.

ACTINISM (a ray), that property of the solar rays whereby they produce chemical effects as in photography.

ACTINOMETER (*measurer of solar rays*), a thermometer with a large bulb, filled with a dark-blue fluid, and enclosed in a box, the sides of which are blackened, and the whole covered with a thick plate of glass.

ACTINOZOA, a group of animals, of which the most familiar examples are the sea-anemones and "coral insects" of the older writers. The term was first employed by de Blainville, to denote a division of the Animal Kingdom, having somewhat different limits from that to which its application is restricted in the present article; in which it is applied to one of the two great divisions of the Cœlenterata, the other being the *Hydrozoa*.

Actinozoa agree with the *Hydrozoa* in the primitive and fundamental constitution of the body of two membranes, an *ectoderm* and an *endoderm*,—between which a middle layer or *mesoderm* may subsequently arise,—in the absence of a completely differentiated alimentary canal, and in possessing thread cells, or nematocysts; but they present a somewhat greater complexity of structure.

This is manifest, in the first place, in their visceral tube, or "stomach," as it is often called, which is continued from the margins of the mouth, for a certain distance into the interior cavity of the body, but which is always open at its fundus into that cavity. And, secondly, in the position of the reproductive elements, which, in the *Hydrozoa*, are always developed in parts of the body wall which are in immediate relation with the external surface, and generally form outward projections; while, in the *Actinozoa*, they are as constantly

situated in the lateral walls of the chambers into which the body cavity is divided. In consequence of this arrangement, the ova, or sexually generated embryos, of the *Actinozoa* are detached into the interior of the body, and usually escape from it by the oral aperture; while those of the *Hydrozoa* are at once set free on the exterior surface of that part of the body in which they are formed.

The *Actinozoa* comprise two groups, which are very different in general appearance and habit, though really similar in fundamental structure. These are:

1. The *Coralligena*, or sea-anemones, coral animals, and sea-pens; and, 2. The *Ctenophora*.

(1.) The *Coralligena*.—A common sea-anemone presents a subcylindrical body, terminated at each end by a disk. The one of these discoidal ends serves to attach the ordinarily sedentary animal; the other exhibits in the centre a mouth, which is usually elongated in one direction, and, at each end, presents folds extending down into the gastric cavity.

The question whether the *Coralligena* possess a nervous system and organs of sense, hardly admits of a definite answer at present. It is only in the *Actinia* that the existence of such organs has been asserted; and the nervous circlet of *Actinia*, described by Spix, has been seen by no later investigator, and may be safely assumed to be non-existent. Subjacent to these Professor Duncan finds ganglion cells and nerve plexuses. It would seem, therefore, that these bodies are rudimentary eyes.

At the breeding season the ova or spermatozoa are evolved in the thickness of the mesenteries, and are discharged into the intermesenteric spaces, the ova undergoing their development within the body of the parent. As the mesenteries increase in numbers, the tentacles grow out as diverticula of the intermesenteric spaces.

In all the *Coralligena*, the development of which has been observed, the embryo is converted into a simple actinozoan in a similar manner; but from this point they diverge in two directions. In these *Hexacoralla* (as they have been termed by Hæckel) the tentacles also usually remain rounded and conical. In the other group, the *Octocoralla*, the mesenteries and the tentacles increase to eight, but do not surpass that number; and the tentacles become flattened and serrated at the edges, or take on a more or less pennatifid character.

There are no *Octocoralla* which retain the simple individuality of the young actinozoan throughout life; but all increase by gemmation, and give rise to compound organisms, which may be aborescent, and fixed by the root end of the common stem, as in the *Alcyonidae* and *Gorgonidae*; or may possess a central stem which is not fixed, and gives off lateral branches which undergo comparatively little subdivision, as in the *Pennatulide*.

In the *Hexacoralla*, on the other hand, one large group, that of the *Actinidae*, consists entirely of simple organisms,—organisms that is, in which the primitive actinozoan attains its adult condition without budding or fission; or if it bud or divide, the products of the operation separate from one another. No true skeleton is formed, all are to some extent locomotive, and some (*Minyas*) float freely by the help of their contractile pedal region. The most remarkable form of this group is the genus *Cereanthus*, which has two circlets, each composed of numerous tentacles, one immediately around the oral aperture, the other at the margin of the disk.

The *Zoanthide* differ from the *Actinide* in little more than their multiplication by buds, which remain adherent, either by a common connecting mass or *cœnosarc* or by stolons; and in the possession of a rudimentary, spicular skeleton.

On the other hand, the proper stone-corals (as contrasted from the red coral) are essentially *Actiniae*, which become converted into compound organisms by gemmation or fission, and develop a continuous skeleton.

The skeleton appears, in all cases to be deposited within the mesoderm, and in the intercellular substance of that layer of the body. Even the definitely shaped spicula of the *Octocoralla* are not the result of the metamorphosis of cells.

In the *Aporosa* the theca and septa are almost invariably imperforate; but in the *Perforata* they present apertures, and in some madreporae the whole skeleton is reduced to a mere network of dense calcareous substance. When the *Hexacoralla* multiply by gemmation or fission, and thus give rise to compound massive or aborescent aggregations, each newly-formed coral polype develops a skeleton of its own, which is either confluent with that of the others, or it is united with them by calcification of the connecting substance of the common body. This intermediate skeletal layer is then termed *canenchyma*.

The *Octocoralla* (excepting *Tubipora*) give rise to no theca and their dependencies, the skeleton of each polype, and of the superficial portion of the polyparium, being always composed of loose and independent spicula.

It has seemed advisable to say thus much concerning the hard parts of the *Actinozoa* in this place, but the details of the structure and development of the skeleton of the *Coralligena* will be discussed under CORALS and CORAL REEFS.

The *Tabulata*, or Millepores, and the *Rugosa*, an extinct and almost exclusively Palæozoic group of stone-coral forming animals, are usually referred to the *Coralligena*. Judging by the figures given by Agassiz of living Millepores, the polypes which cover its surface are undoubtedly much more similar to coryiniform *Hydrozoa* than they are to any *Actinozoan*.

Phenomena analogous to the "alternation of generations," which is so common among the *Hydrozoa*, are unknown among the great majority of the *Actinozoa*. But Semper has recently described a process of sexual multiplication in two species of *Fungia*, which he ranks under this head.

The *Ctenophora*.—These are all freely swimming, actively locomotive, marine animals, which do not multiply by gemmation, nor form compound organisms such as the polyparies of the *Coralligena*.

In their development the *Ctenophora* resemble the *Coralligena* in all essential respects, though they differ from them in some details. Thus the process of yelk division goes on at a different rate in the two moieties of the egg, so that the vitellus becomes divided into one set of small and another set of large cells, whereof the latter become overlaid by the former, and give rise to a large-celled hypoblast, enclosed within a small-celled epiblast. But in the manner in which the body cavity is formed, and the visceral tube (which becomes the stomach) is developed, the *Ctenophora* resemble the *Actiniae*. The paddles make their appearance at four points of the circumference of the body, in the form of elevations beset with short cilia; but each of these divides into two, and thus the eight definitive series are constituted.

There is a general agreement among anatomists respecting the structure of the *Ctenophora* thus far; but the question whether they possess a nervous system and sensory organs or not, is, as in the case of the *Coralligena*, one upon which there exists great diversity of opinion. Grant originally described a nervous ganglionated ring, whence longitudinal cords proceed in *Cydippe* (*Pleurobrachia*); but his observation has not been verified by subsequent investigations. According to Milne

Edwards, followed by others (among whom is included Professor Huxley), the nervous system consists of a ganglion, situated at the aboral pole of the body, whence nerves radiate, the most conspicuous of which are eight cords which run down the corresponding series of paddles; and a sensory organ, having the characters of an otolithic sac, is seated upon the ganglion. Agassiz and Kölliker, on the other hand, have denied that the appearances described (though they really exist) are justly interpreted. And again, though the body described as an otolithic sac, undoubtedly exists in the position indicated in all, or most, of the *Ctenophora*, the question has been raised whether it is an auditory or a visual organ.

These problems have been recently reinvestigated with great care, and by the aid of the refined methods of modern histology, by Dr. Eimer, who describes a nervous system, consisting of extremely delicate varicose ultimate nerve fibrils, which traverse the mesoderm in all directions, and are connected here and there with ganglionic corpuscles. These nerves are only discernible with high magnifying powers, as they are for the most part isolated, and are connected into bundles only beneath the longitudinal canals. The mass which lies beneath the lithocyst is composed of cells, but these have none of the special characters of nerve cells. Eimer states that he has traced the filaments, which he considers to be nerves, into direct continuity with muscular fibres; and, around the mouth, into subepidermal bodies, which he regards as rudimentary forms of tactile corpuscles.

Many *Actinozoa* (*Pennatulidae* *Ctenophora*) are phosphorescent; but the conditions which determine the evolution of light have not been determined.

All *Actinozoa* are marine animals, and the distribution of many of the families (*Actinidae*, *Turbinolidae*, *Pennatulidae*, *Beroïdæ*) is extremely wide, and bears no ascertainable relation to climate.

ACTION, in Law, is the process by which redress is sought in a court of justice for the violation of a legal right. The word is used by jurists in three different senses. Sometimes it is spoken of as a right—the right, namely, of instituting the legal process; sometimes, and more properly, it means the legal process itself; and sometimes the particular form which it assumes. The most universally recognized division of actions is the division established by Roman lawyers in actions *in rem* and *in personam*.

ACTION, in English Law, means the form of civil process hitherto observed in the Courts of Common Law.

ACTION (under the Supreme Court of Judicature Act, 1873). By this Act, which establishes one supreme court in place of the Superior Courts of Common Law and the High Court of Chancery, action is the name given to the proceeding in the High Court of Justice, which takes the place of the old actions at common law, suits instituted by bill or information in the Court of Chancery, causes *in rem* in the Court of Admiralty, or by citation in the Court of Probate.

ACTIUM, in Ancient Geography, a promontory in the north of Acarnania, at the mouth of the Sinus Ambracius, opposite the town of Nicopolis, built by Augustus on the north side of the strait.

ACTON, a large village in Middlesex, about eight miles west of St. Paul's, London. Population, 12,000.

ACTON, SIR JOHN FRANCIS EDWARD, son of Edward Acton, who practised as a physician at Besançon, was born there in 1736, and succeeded to the title and estates in 1791, on the death of his cousin in the third degree, Sir Richard Acton. He served in the navy of France, and afterwards in that of Tuscany, and commanded a frigate in the joint expedition of Spain

and Tuscany against Algiers in 1774. His gallantry in rescuing three or four thousand Spanish soldiers from slavery led to his advancement. He died in 1811.

ACTUARY, in ancient Rome, was the name given to the clerks who recorded the *Acta Publica* of the Senate, and also to the officers who kept the military accounts and enforced the due fulfilment of contracts for military supplies. In its English usage the word has undergone a gradual limitation of meaning.

ACUNA, CHRISTOVAL D', a Spanish Jesuit, born at Burgos in 1597. He was admitted into the society in 1612, and, after some years spent in study, was sent as a missionary to Chili and Peru, where he became rector of the College of Cuenca. After occupying the positions of procurator of the Jesuits at Rome, and *calificador* (censor) of the Inquisition at Madrid, Acuña returned to South America, where he died, probably soon after the year 1675.

ACUPRESSURE in *Surgery* (*acus*, a needle, *premo*, I press), a method of restraining hæmorrhage, introduced in 1869 by the late Sir J. Y. Simpson. The closure of the vessel near the bleeding point is attained by the direct pressure of a metallic needle, either alone or assisted by a loop of wire.

ACUPUNCTURE, the name of a surgical operation among the Chinese and Japanese, which is performed by pricking the part affected with a silver needle.

ADAFUDIA, a large town of Western Africa, in the country of the Felattahs, in 13° 6' N. lat., 1° 3' E. long., about 400 miles southeast of Timbuctoo. Pop., 30,000.

ADAGIO (*Italian*), a slow movement or measure of time in music.

ADAL, a region in Eastern Africa, with a coast line extending, between 11° 30' and 15° 40' N. lat., from the Gulf of Tajurah to the neighborhood of Massowah. For about 300 miles it borders on the Red Sea, the coast of which is composed of coral rock. It stretches inland to the mountain terraces, to the west of which lie the Abyssinian table-land of Shoa and Tigré, with a breadth near Massowah of only a few miles, but widening towards the south to 200 or 300 miles. The northern portion of this region is known as the Afar country.

ADALBERT, SAINT, one of the founders of Christianity in Germany, known as the Apostle of the Prussians, was born of a noble family in Slavonia, about 955; was educated at the monastery of Magdeburg in 953, was chosen Bishop of Prague and died in 997.

ADALBERT, Archbishop of Bremen and Hamburg, born of the noble Saxon family of the Counts of Wettin, was one of the most remarkable ecclesiastics of the 11th century. Through the friendship of the emperor Henry III. he was elevated in 1043, when only about thirty years old, to the see of Bremen and Hamburg, which included the whole of Scandinavia, and he accompanied the monarch in his journey to Rome (1046). Here it is said that he was offered and that he refused the papal throne. He died at Goslar in 1072, having done much during his last years to inflame the Saxons' hatred of Henry, which resulted soon afterwards in their revolt.

ADAM, an appellative noun, meaning the first man. In Genesis ii. 7, 25, iii. 8, 20, iv. 1, &c., it assumes the nature of a proper name, and has the article *the man*, the only one of his kind; yet it is appellative, correctly speaking. In Genesis i. 26, 27, v. 2, it is simply appellative, being applied to both progenitors of the human race; not to the first man alone as in the second, third, and fourth chapters. The etymology of the word is uncertain, but it is probably connected with a root signifying *red*, so that the idea is one *red* or *ruddy*.

The early part of Genesis contains two accounts of man's creation. These narratives need not be examined at present farther than man's origin is concerned.

In Genesis i. 26, 27, we read, "And God said, Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. So God created man in his *own* image; in the image of God created he him; male and female created he them." At the end of the sixth day of creation man appears, the noblest of earth's inhabitants. In Genesis ii. 7, 8, we also read, "And the LORD formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul. And the LORD God planted a garden eastward in Eden; and there he put the man he had formed." The woman's creation is thus narrated in subsequent verses of the same chapter — 20, 21, 22, 23, "And Adam gave names to all cattle, and to the fowl of the air, and to every beast of the field; but for Adam there was not found an helpmeet for him. And the LORD God caused a deep sleep to fall upon Adam, and he slept: and he took one of his ribs, and closed up the flesh instead thereof. And the rib, which the LORD God had taken from man, made he a woman, and brought her unto the man. And Adam said, This *is* now bone of my bones, and flesh of my flesh: she shall be called Woman, because she was taken out of man." Between these accounts some discrepancy exists. The first represents the man and woman to have been created together, after the various creatures which the earth sustains on its surface; the second makes Adam to have been created first, then the various animals, with the woman last of all. The creation of animals separates the origin of the man and the woman. The first narrator states that man was made in the image and form of God, without explaining his meaning more particularly. Hence interpreters differ in attempting to define it.

The narrative in the first chapter is arranged according to a definite plan. Six days are allotted to the creation of the heavens and earth, with all their furniture, animate and inanimate. After due preparation had been made by the formation of light, atmosphere, and land separated from water, life is called into existence, first vegetable, then animal, terminating in man, the lord of this lower world. The narrative in chapters ii. -iv. does not present such orderly progress. In it man is the central figure, to whom all is subordinated. He is created first. For him plants and trees are made to spring up. He is placed in a delightful garden. The Lord God, perceiving his solitary condition, creates the beasts of the field and the fowls of the air; but when brought to the protoplast, they were insufficient to supply his mental void, so that woman was made, in whom he found a suitable partner.

According to the second narrative, Jehovah planted a garden in Eden, eastward, and put the first man there. A spring or stream rising in Eden, and flowing through the garden, supplied it with water. In issuing from the garden it divided itself into four rivers, each having its own course. The writer gives their names, and the countries washed by three of them.

The garden has two remarkable productions — the tree of life, and the tree of knowledge of good and evil. The former derives its name from the virtue of its fruit to impart perpetual life or immortality. The fruit of the latter communicates the knowledge of good and evil. It awakens moral consciousness. The one had to do with physical, the other with spiritual life. Such were the miraculous powers of the two trees in the midst of the garden.

Are these narratives of the creation, primal abode, and fall of man, literal history? So some have always believed, with Augustine and the Reformers. The dif-

faculties in the way of this interpretation are great. As it cannot be carried out consistently, its advocates resort to various expedients. They forsake the literal for the figurative wherever necessity demands. Thus they put a figurative construction on the language of the curse, because they allege that a literal one would be frigid, utterly unworthy of the solemn occasion, highly inconsistent with the dignity of the speaker and the condition of the parties addressed. Sometimes they even incline to regard the narrative as a sort of poem, or give it a poetical character.

Are the narratives allegorical? So Philo interprets them, followed by the Greek fathers of Alexandria, Clement and Origen, as well as by Ambrose. In modern times Coleridge read the whole as an allegory. So did Donaldson in his *Jashar*. There is no indication, however, that allegories were intended.

The traditions of ancient nations present analogies to the creation of man given in the first chapter of Genesis. The Etrurian comes nearest to the Hebrew. There creation takes place in six periods of a thousand years each, and men appear in the last, after the earth, sun, moon, and stars, with all living things on the surface of the globe, had been brought into existence by God. The Persian mythology, in like manner, makes Ormuzd, the god of light, create by his word *Honover* the visible world in six periods of a thousand years each, and man is formed last. The name of the first man is Kaiomorts. The Chaldee myth, given by Berosus, presents little resemblance to the Hebrew narrative. Bel, the highest god, divided the darkness, and cut the woman, who ruled over the monstrous creatures found at first in *the all*, into two halves, out of which heaven and earth were formed. After that he cut off his own head. The blood trickling down was taken by other gods and mixed with earth, from which men were formed, who are therefore wise, and partakers of the divine intelligence. The Phœnician myth is still more unlike the Hebrew account. But Ovid's teaching is that man was made in the image of the gods, and was intended to be ruler of the earth. The Egyptian theology has no point of contact with the Hebrew. The Indian accounts are very numerous, but often discrepant. Their likeness to the Hebrew narrative is remote; for the play of imagination appears in them to excess and absurdity.

The paradisiacal state of the first pair, and their loss of it as described in the second and third chapters of Genesis, have their parallels in the myths of ancient nations. According to the Persian traditions, Meschia and Meschiane, the progenitors of mankind, were created for happiness in this world and the next, on condition that they were good, and did not worship Dews. At first they acted according to their original nature, acknowledging that all beings were derived from Ormuzd.

Ahriman is represented as a poisonous serpent, and springs in this form from heaven to earth. Dews often take the same form.

The tree *Hom* among them is similar to the tree of life. It imparts immortality, and is called the king of trees.

The holy mountain or paradise of Persian tradition is *Albordj*, the abode of Ormuzd and the good spirits, which sends forth great rivers. This means the Hindu Koosh mountains, where was *Airjana veedjo*, the first seat of the Aryan race.

According to the religion of Lama or the Calmucks, men lived in the first age of the world 80,000 years. They were holy and happy. But their happiness came to end. A plant, as sweet as honey, sprang out of the earth, of which a greedy man tasted, and made others acquainted with it. A sense of shame was awakened, and therefore they began to make themselves coverings

of the leaves of trees. Their age and size decreased. Virtue fled, and all manner of vice prevailed.

The Greek myths are remotely parallel. Hesiod describes the primitive state as one free from toil, sickness, and all kinds of evil. Mortals were contented with easily obtained, though poor, sustenance. But cunning Prometheus deceived Zeus, and stole fire from heaven. The latter, by way of punishment, sent a beautiful woman, Pandora, whom Epimetheus accepted as a gift. Having with her a vessel into which all sorts of misery had been put, she opened it out of curiosity, and evils flew forth in abundance, filling the earth. Hope alone remained at the bottom.

The points of similarity between the Old Testament and this Greek representative of man's fall are tolerably plain. In both there is an original state marked by freedom from sorrow, by complete earthly enjoyment and undisturbed peace with God. Both attach the origin of evil to the act of a free being putting himself in opposition to God—evil being the punishment of that act, arising by means of a woman. As the Old Testament narrative implies that the step taken by man was not a mere degeneracy, so Æschylus's description admits that it was for humanity the beginning of a richer and higher life, since man's proper destiny could not be worked out in a condition of childlike incapacity. Pandora reminds us of Eve; Epimetheus of Adam. Prometheus and the serpent both wish to make men like God in knowledge and happiness. The tragic poet seems to regard Prometheus as the archetype of man, so that his fate is theirs. Like every strong-willed mortal, Prometheus flounders on the rock of presumption. He persists in acting contrary to the commands of Deity, and endures torture till he submits to a higher will, accepting the symbols of repentance and restraint with certain limits. Thus, like Adam, he is the representative of humanity.

The fundamental difference between the Hebrew and Greek narratives is, that the distinction between God and the world, spirit and nature, maintained with all sharpness in the one, is not carried out in the other. On the contrary, the Greek myth mixes the two spheres, so that the world appears as the original, independent element, of which spirits and deity are mere products. In the Hebrew narrative the spiritual features are presented clearly and simply; in the Greek they are indistinct, because transferred to the sensuous world, and covered with a luxuriant growth of outer nature.

A number of absurd fables, the fancies of Jewish writers, have gathered round the simple narratives of the Old Testament, and are incorporated in the Talmud. In these Adam is said to have been made as a man-woman out of dust collected from every part of the earth; his head reached to heaven, and the splendor of his face surpassed the sun. The very angels feared him, and all creatures hastened to pay him devotion. The Lord, in order to display his power before the angels, caused a sleep to fall upon him, took away something from all his members, and when he awoke, commanded the parts that had been removed to be dispersed over the globe, that the whole earth might be inhabited by his seed. Thus Adam lost his size, but not his completeness. His first wife was Lilith, mother of the demons. But she flew away through the air; and then the Lord created Eve from his rib, brought her to Adam in the most beautiful dress, and angels descending from heaven played on heavenly instruments; sun, moon, and stars dancing. He blessed the pair, and gave them a feast upon a table of precious stone. Angels prepared the most costly viands. But Adam's glory was envied by the angels; and the seraph Sammael succeeded in seducing him. The

pair were driven out of paradise into the place of darkness, and wandered through the earth.

In the emanation systems of the Christian Gnostics and Manichæans, as well as in the gnosis of the Mandæans, Adam is represented as one of the first and holiest æons. Both catholic and heretical literature indulged in fictions respecting Adam.

ADAM of BREMEN, ecclesiastical historian, was born in Upper Saxony, and in 1067, probably on the invitation of Archbishop Adalbert, came to Bremen, where he was appointed canon and *magister scholarum*. He died in 1076.

ADAM, ALEXANDER, Rector of the High School, Edinburgh, was born on the 24th of June, 1741, near Forbes, in Scotland. From his earliest years he showed uncommon diligence and perseverance in classical studies, notwithstanding many difficulties and privations. He died on the 18th of December, 1809, after an illness of five days, during which he occasionally imagined himself still at work, his last words being,—"But it grows dark; you may go."

ADAM, MELCHIOR, German divine and biographer, was born at Grottkaw in Silesia after 1550, and educated in the college of Brieg, where he became a Protestant. He was enabled to pursue his studies there by the liberality of a person of quality, who had left several exhibitions for young students. In 1598 he went to Heidelberg, where he became conrector of the gymnasium and died in 1622.

ADAM, ROBERT, architect, the second son of William Adam of Maryburgh, in Fife, was born in 1728. He studied at the University of Edinburgh, and probably received his first instruction in architecture from his father, who, whether a professional architect or not, gave proofs of his skill and taste in the designs of Hopetoun House and the Edinburgh Royal Infirmary. In 1754 young Adam visited the Continent, and spent three years in Italy for the purpose of examining the ruins of Roman architecture. The magnificence of the public baths erected at Rome in the time of Diocletian having impressed him with the idea that there had been a marked revival of architectural art during that emperor's reign, he resolved to visit the ruins of the private palace Diocletian had erected at Spalatro in Dalmatia. He continued actively engaged in his profession until his death in 1792. James, his brother and associate in labor, died in 1794.

ADAM, RIGHT HON. WILLIAM, nephew of the preceding, eldest son of John Adam, Esq., of Blair-Adam, Kinross-shire, was born on the 2d of August, 1751, studied at the Universities of Edinburgh and Glasgow, and passed at the Scotch bar in 1773. Soon after he removed to England, where he entered Parliament in 1774, and in 1782 was called to the Common-law bar. He was successively Attorney and Solicitor General to the Prince of Wales, one of the managers of the impeachment of Warren Hastings, and one of the counsel who defended the first Lord Melville when impeached (as Mr. Dundas). During his party's brief tenure of office in 1806 he was Chancellor of the Duchy of Cornwall, and was afterwards a privy councillor and lord-lieutenant of Kinross-shire. In 1814 he became a baron of Exchequer in Scotland. He died at Edinburgh on the 17th of February, 1839.

ADAM'S APPLE, the popular name of the projection in the fore-part of the neck formed by the anterior extremity of the thyroid cartilage of the larynx. The name comes from the notion that the lump was caused by a piece of the "forbidden fruit" sticking in Adam's throat.

ADAM'S BRIDGE, or *Rama's Bridge*, a chain of sand-banks, extending from the island of Manaar, near

the N. W. coast of Ceylon, to the island of Rameseram off the Indian coast, and lying between the Gulf of Manaar on the S. W. and Palk Strait on the N. E.

ADAM'S PEAK, a lofty mountain in Ceylon, about 45 miles E. from Colombo, in N. lat. 6° 55', E. long. 80° 30'. It rises steeply to a height of 7,240 feet, and commands a magnificent prospect.

ADAMANT, from the Greek *Adamas*, an adjective meaning "invincible," originally applied to substances of extraordinary hardness, and used as a synonym for diamond.

ADAMAWA, a country of Central Africa, lies between 7° and 11° N. lat. and 11° and 16° E. long., about midway on the map between the Bight of Biafra and Lake Chad. Its boundaries cannot be strictly defined, but it stretches from S. W. to N. E. a distance of 200 miles, with a width of from 70 to 80 miles. This region is watered by the Benuwe and the Faro. The former, which ultimately unites with the Niger, flows through Adamawa, first in a northerly, then in a westerly direction, and is joined by the Faro, which rises in the south, 22 miles from Yolla, the capital of the country. The country, which is exceedingly rich and is covered with luxuriant herbage, has many villages and a considerable population. The grain known as *Holcus sorghum* or *durra*, ground-nuts, yams and cotton are the principal products, and the palm and banana abound. Elephants are very numerous, and ivory is largely exported. In the eastern part of the country the rhinoceros is met with, and the rivers swarm with crocodiles and with a curious mammal called the *ayu*.

ADAMITES, or ADAMIANS, a sect of heretics that flourished in North Africa in the 2d and 3d centuries. Basing itself probably on a union of certain gnostic and ascetic doctrines, this sect pretended that its members were re-established in Adam's state of original innocence. They accordingly rejected the form of marriage, which, they said, would never have existed but for sin, and lived in absolute lawlessness, holding that, whatever they did, their actions could be neither good nor bad. In 1421 they were almost exterminated by Ziska, the leader of the Hussites, who committed many of them to the flames.

ADAMNAN or ADOMNAN, SAINT, born in Ireland about the year 624, was elected Abbot of Iona in 679, on the death of Faillbhe. He died in 704.

ADAMS, JOHN, a distinguished statesman and second president of the United States. He was born on the 19th or (new style) 30th of October, 1735, in that part of the township of Braintree, in Massachusetts, which on a subsequent division was called Quincy. After graduating in 1755, he removed to the town of Worcester, where according to the economical practice of that day in New England, he became a tutor in a grammar school, and at the same time was initiated into the practice of law in the office of Mr. Putnam, then an attorney and a colonel of militia, and subsequently a general of some celebrity in the Revolutionary War.

He was admitted to practice in the year 1758, and gradually rose to the degree of eminence which a local court can confer; and obtained distinction by some essays on the subject of the canon and feudal law, which were directed to point to the rising difference which commenced between the mother country and the colonies, soon after the peace of 1763 had delivered the latter from all disquietude respecting the establishments of France in the adjoining province of Canada. Two years after, he was chosen one of the representatives of his native town to the congress of the province. His first prominent interference in political affairs was at a meeting at Braintree in 1765, to oppose the Stamp Act. The resolutions he proposed were not only carried unanimously,

but were afterwards adopted verbatim by more than forty other towns. In 1768 he found it necessary to remove to Boston, owing to the increase of his legal practice.

When it was determined, in 1774, to assemble a general congress from the several colonies, Mr. Adams was one of those solicited for the purpose by the people of Massachusetts. Before departing for Philadelphia to join the congress, he parted with the friend of his youth, his fellow-student and associate at the bar, Jonathan Sewall, who had attained the rank of attorney-general, and was necessarily opposed to his political views. Sewall made a powerful effort to change his determination, and to deter him from going to the congress. To this Adams replied: "I know that Great Britain has determined on her system, and that very fact determines me on mine. You know I have been constant and uniform in opposition to her measures; the die is now cast; I have passed the Rubicon; to swim or sink, live or die, survive or perish with my country, is my unalterable determination." The conversation was then terminated by Adams saying to his friend, "I see we must part; and with a bleeding heart, I say, I fear for ever. But you may depend upon it, this adieu is the sharpest thorn on which I ever set my foot."

When the continental congress was assembled Mr. Adams became one of its most active and energetic leaders, and signed the Declaration of Independence.

In 1777 he, with three other members, was appointed a commissioner to France.

In 1785 Mr. Adams was appointed ambassador to the court of his former sovereign, where his conduct, was such as to secure the approbation of his own country, and the respect of that to which he was commissioned. Whilst in London, he published his work entitled *Defence of the American Constitution*, in which he combated ably the opinions of Turgot, Mably, and Price, in favor of a single legislative assembly; and thus perhaps contributed to the division of power and the checks on its exercise, which became established in the United States. At the close of 1787 he returned, after ten years devoted to the public service, to America. He received the thanks of Congress, and was elected soon after, under the presidency of Washington, to the office of Vice-President. In 1790 Mr. Adams gave to the public his *Discourses on Davila*, in which he exposed the revolutionary doctrines propagated by France and her emissaries in other countries. On the retirement of Washington, the choice of President fell on Mr. Adams, who entered on that office in May 1797.

He was not especially successful in his administration, lost the confidence of his party and failed to obtain a renomination. On leaving office he retired to his native place, where he died on July 4, 1826, the same day as Jefferson died, and the fiftieth anniversary of the signing of the Declaration of Independence.

ADAMS, JOHN QUINCY, eldest son of the preceding, was born at Braintree on the 11th July 1767. The greater part of his education was received in Europe, which he visited in company with his father in 1778, and again in 1780, when he attended for a time the university of Leyden. When only fifteen years old he went, as secretary, with Francis Dana on his unsuccessful mission to St. Petersburg. Returning home, he graduated at Harvard in 1788, and was admitted to the bar in 1791. He was ambassador to the Hague in 1794, and was sent to Berlin as ambassador by his father. On Jefferson becoming president (1801), Adams was recalled, and resumed the practice of law in Boston. In 1802 Suffolk county returned him a member of the Massachusetts Senate, and in the following year he was elected to Congress. Indebted for his position to the Federal party, Adams supported their views for

four years, but separated from them by voting for Jefferson's proposed *embargo*. This course involved him in much controversy, and cost him his seat in the Senate. In 1809 Madison, having obtained after some delay the concurrence of the Senate, entrusted Adams with the embassy to St. Petersburg. When war broke out between England and the United States, Adams induced the Czar to make an offer of intervention, which, however, the English Government declined to accept. After serving for two years (1815-17) as minister in London, he again entered the arena of home politics as secretary of state under Monroe. In this office he distinguished himself specially by his arrangement of the treaty with Spain, which defined the boundaries of the ceded territories of Florida and Louisiana. An elaborate report on weights and measures gained for him also a name for scientific acquirements. In 1825 the election of a president fell, according to the constitution of the States, to the House of Representatives, since no one of the candidates had secured an absolute majority of the electors chosen by the States, and Adams, who had stood second to Jackson in the electoral vote, was chosen in preference to Jackson, Clay, and Crawford. The administration of Adams was marked by the imposition of a high tariff on foreign goods, with the view of promoting internal industry, and by the unsuccessful attempt to purchase Cuba from Spain. He died of paralysis on 23d February, 1848, having been seized two days previously while attending the debates of Congress. Adams wrote a number of works, which are now of little importance.

ADAMS, RICHARD, M. A., divine. Two contemporaries of the same name are frequently confounded with each other. The more eminent was son of the Rev. Richard Adams, rector of Worrall, in Cheshire. The family records seven clergymen of the Church of England in succession. The present worthy was born at Worrall, but the loss of the registers leaves the date uncertain. He died in 1608.

ADAMS, SAMUEL, American statesman, born at Boston, Sept. 27, 1722, was second cousin to John Adams. He studied at Harvard, but, owing to his father's misfortunes in business in connection with a banking speculation,—the "manufactory scheme,"—he had to leave before completing his course, and to relinquish his intention of becoming a Congregational clergyman. In all the proceedings which issued at last in the declaration of independence, Adams was a conspicuous actor. He took part in the numerous town meetings, drafted the protest which was sent up by Boston against the taxation scheme of Grenville (May 1764); and, being chosen next year a member of the general court of Massachusetts, soon became one of the leaders in debate. His uncompromising resistance to the British Government continued; he was a prominent member of the Continental Congress at Philadelphia, and was one of those who signed the Declaration of Independence in 1776. From 1789 to 1794 he was lieutenant-governor of the State, and governor from 1794 to 1797, retiring in the latter year partly on account of age, but partly also because the Federalists were then in the ascendant, and he himself was inclined to the Jefferson or Republican party. He died on the 3d Oct. 1803. In an oration on American independence, delivered in Philadelphia, 1st Aug. 1776, Adams characterises the English as "a nation of shopkeepers." The oration was translated into French, and published at Paris; and it is therefore not unlikely that Napoleon's use of this phrase was not original.

ADAMS, THOMAS—"the prose Shakespeare of Puritan theologians," as Southey named him—has left as

few personal memorials behind him as the poet himself. His numerous works display great learning, classical and patristic, and are unique in their abundance of stories, anecdotes, aphorisms and puns. He was a Puritan in the church as distinguished from the Nonconformist Puritans. He died about 1660.

ADAMS. See NORTH ADAMS.

ADAMSON, PATRICK, a Scottish prelate, Archbishop of St. Andrews, was born in the year 1543, in the town of Perth, where he received the rudiments of his education. He afterwards studied philosophy, and took his degree of master of arts at the University of St. Andrews. In 1564 he set out for Paris as tutor to the eldest son of Sir William Macgill. In the month of June of the same year, Mary Queen of Scots being delivered of a son, afterward James VI. of Scotland and I. of England, Mr. Adamson wrote a Latin poem, in which he gave the prince the title of king of France and England. This proof of his loyalty involved him in difficulties. The French court was offended, and ordered him to be arrested; and he was confined for six months. He was released only through the intercession of Queen Mary and some of the principal nobility, who interested themselves in his behalf. As soon as he recovered his liberty, he retired with his pupil to Bourges. He was in this city during the massacre at Paris; and the same persecuting spirit prevailing among the Catholics at Bourges as at the metropolis, he lived concealed for seven months in a public-house, the aged master of which, in reward for his charity to heretics, was thrown from the roof, and had his brains dashed out. In 1588 accusations were brought against him. The year following he published the Lamentations of the prophet Jeremiah in Latin verse, which he dedicated to the king, complaining of his hard usage. The king was unmoved by his application, and granted the revenue of his see to the Duke of Lennox, so that the prelate and his family were literally reduced to the want of bread. During the remaining part of his unfortunate life he was supported by charitable contributions, and died in 1592.

ADANA, a city of Asia Minor, the capital of the province of the same name, on the right bank of the Sihun, about 30 miles from the sea, in N. lat. 37° 1', E. long. 35° 18'. It is built on the site of the ancient *Antiochia ad Sarum*. The population of the town is 45,000; of the province, 403,400.

ADANSON, MICHEL, a celebrated French naturalist, descended from a Scottish family which had at the Revolution attached itself to the fortunes of the house of Stuart, was born the 7th of April 1727, at Aix, in Provence, where his father was in the service of M. de Vintimille, archbishop of that province. On the translation of this prelate to the archbishopric of Paris, about the year 1730, the elder Adanson repaired thither with his five children, who were all provided for by their father's patron. A small canonry fell to the lot of Michel, the revenue of which defrayed the expenses of his education at the college of Plessis. While there he was distinguished for great quickness of apprehension, strength of memory, and mental ardor; but his genius took no particular bent, until he received a microscope from the celebrated Tuberville Needham, who was struck with admiration of the talents and acquirements he displayed at a public examination. From that time to the last hour of his life he persevered with a zeal almost unexampled in the observation and study of nature. He had been elected a member of the Academy of Sciences in 1759, and he latterly subsisted on a small pension it had conferred on him. Of this he was deprived on the dissolution of the Academy by the Constituent Assembly, and was consequently reduced to such a depth of poverty

as to be unable to appear before the French Institute when it invited him to take his place among its members. Government afterward conferred upon him a pension sufficient to relieve the simple wants of the great naturalist. He died, after months of severe suffering, on the 3d of August 1806, requesting, as the only decoration of his grave, a garland of flowers gathered from the 58 families he had differentiated—"a touching though transitory image," says Cuvier, "of the more durable monument which he has erected to himself in his works." His zeal for science, his unwearied industry, and his talents as a philosophical observer, are conspicuous in all his writings. The serenity of his temper, and the unaffected goodness of his heart, endeared him to the few who knew him intimately. On his return from Africa in 1754, he laid before the French Indian Company a scheme for the settlement of a colony in Senegal, where articles of African produce might be cultivated by free negroes. His propositions were unheeded by his countrymen, and, by a misdirected patriotism, he refused to present them to the Abolitionists of England. A similar feeling led him to refuse to settle in Austria, Russia, or Spain, on the invitation of the sovereigns of those countries. His most important works are his *Natural History of Senegal* and his *Families of Plants*.

ADAPTATION, in *Biology*, is the process by which an organism or species of organism becomes modified to suit the conditions of its life. Every change in a living organism involves adaptation; for in all cases life consists in a continuous adjustment of internal to external relations. The term is usually restricted, however, to imply such modifications as arise during the life of an individual, when an external change directly generates some change of function and structure.

ADDA, the ancient *Addua*, a river of Northern Italy, formed by the union of several small streams, near the town of Bormio, in the Rhetian Alps, flows westward through the Valtellina into the Lake of Como, near its northern extremity.

ADDER, the common viper (*Vipera communis*). The death adder (*Acanthopis tortor*) of Australia, and the puff adder (*Crotalus arietans*) of South Africa, are both highly poisonous.

ADDINGTON, HENRY, VISCOUNT SIDMOUTH, prime minister of England, eldest son of Dr. Anthony Addington, was born at Reading on the 30th May 1757. He was educated at Winchester and at Brazenose College, Oxford. In 1784 he was called to the bar at Lincoln's Inn, but being elected about the same time member of Parliament for Devizes, he did not enter on legal practice. He was already on terms of intimacy with the younger Pitt, his father having been Lord Chatham's medical adviser (a circumstance that secured for young Addington the nickname in Parliament of "the Doctor"); and he attached himself, as was natural, to the party of the great commoner. His fidelity to Pitt received a speedy and ample acknowledgment when he was elected, in May 1789, speaker of the House, in succession to Grenville. For a period of twelve years he discharged the duties of the chair to the general satisfaction of all parties, if with no very marked ability. In 1801, when Pitt resigned on the question of Catholic emancipation, Addington succeeded him in the offices of prime minister and chancellor of the exchequer. In January 1805 he joined the cabinet as president of the council, accepting at the same time the dignity of a peerage, which he had previously declined. He resigned office, however, in July of the same year, in consequence of the share he took in the prosecution of Lord Melville having estranged him from Pitt. After the death of the latter in 1806, he became lord privy seal, and subsequently lord president in the cabinet of Fox and Gren-

ville, but resigned office in 1807. He became a third time lord president under Mr. Perceval in 1812, and in June of the same year received the seals of the Home Office under the administration of Lord Liverpool. He held this position for ten eventful years, during which he received his full share of the hostile criticism to which home secretaries are peculiarly exposed. The policy of repression which he pursued in regard to the reform meeting at Manchester in 1819, was not justifiable even according to the limited ideas of liberty prevalent at that time. He died in 1844.

ADDISON, JOSEPH, was the eldest son of Lancelot Addison, Dean of Lichfield, and was born at his father's rectory of Milston, England, on the 1st day of May, 1672. He took his master's degree in 1693, and held a fellowship from 1699 till 1711.

The eleven years extending from 1693, or his twenty-first year, to 1704, when he was in his thirty-second, may be set down as the first stage of his life as a man of letters. During this period, embracing no profession, and not as yet entangled in official business, he was a student, an observer, and an author; and though the literary works which he then produced are not those on which his permanent celebrity rests, they gained for him in his own day a high reputation.

His first literary efforts were poetical. In 1693 a short poem of his, addressed to Dryden, was inserted in the third volume of that veteran writer's *Miscellanies*. The next volume of this collection contained his translation, in tolerable heroic couplets, of "all Virgil's *Fourth Georgic*, except the story of Aristæus." Two and a half books of Ovid were afterwards attempted; and to his years of early manhood belonged also his prose *Essay on Virgil's Georgics*, a performance which hardly deserved, either for its style or for its critical excellence, the compliment paid it by Dryden, in prefixing it to his own translation of the poem. The most ambitious of those poetical essay-pieces is the *Account of the Greatest English Poets*, dated April 1694, and addressed affectionately to Sacheverell, the poet's fellow-collegian, who afterwards became so notorious in the party-quarrels of the time. In the summer of 1699 he crossed into France, where, chiefly for the purpose of learning the language, he remained till the end of 1700; and after this he spent a year in Italy. In Switzerland, on his way home, he was stopped by receiving notice that he was to be appointed envoy to Prince Eugene, then engaged in the war in Italy. Towards the end of 1703, Addison returned to England.

Works which he composed during his residence on the Continent were the earliest that showed him to have attained maturity of skill and genius.

With the year 1704 begins a second era in Addison's life, which extends to the summer of 1710, when his age was thirty-eight. This was the first term of his official career; and, though very barren of literary performance, it not only raised him from indigence, but settled definitively his position as a public man. His correspondence shows that, while on the Continent, he had been admitted to confidential intimacy by diplomatists and men of rank; immediately on his return he was enrolled in the Kitcat Club, and brought thus and otherwise into communication with the gentry of the Whig party. Although all accounts agree in representing him as a shy man, he was at least saved from all risk of making himself disagreeable in society, by his unassuming manners, his extreme caution, and that sedulous desire to oblige, which his satirist Pope exaggerated into a positive fault.

ot long after Marlborough's great victory at Blenheim, it is said that Godolphin, the lord treasurer, expressed to Lord Halifax a desire to have the great duke's fame extended by a poetical tribute. Halifax

seized the opportunity of recommending Addison as the fittest man for the duty; stipulating, we are told, that the service should not be unrewarded, and doubtless satisfying the minister that his protégé possessed other qualifications for office besides dexterity in framing heroic verse. *The Campaign*, the poem thus written to order, was received with extraordinary applause; and it is probably as good as any that ever was prompted by no more worthy inspiration.

The consideration covenanted for by the poet's friends was faithfully paid. A vacancy occurred by the death of another celebrated man, John Locke; and in November 1704, Addison was appointed one of the five commissioners of appeal in Excise. In 1706 he became one of the undersecretaries of state, serving first under Hedges, who belonged to the Tory section of the Government, and afterwards under Lord Sunderland, Marlborough's son-in-law, and a zealous follower of Addison's early patron, Somers. In 1708 he entered Parliament, sitting at first for Lostwithiel, but afterwards for Malmesbury, which, being six times elected, he represented from 1710 till his death. Here unquestionably he did fail. What part he may have taken in the details of business we are not informed, but he was always a silent member, unless it be true that he once attempted to speak and sat down in confusion. During the last few months of his tenure of office Addison contributed largely to the *Tatler*. But his entrance on this new field does nearly coincide with the beginning of a new section in his history.

Even the coalition-ministry of Godolphin was too Whiggish for the taste of Queen Anne; and the Tories, the favorites of the court, gained, both in parliamentary power and in popularity out of doors, by a combination of lucky accidents, dexterous management, and divisions and double-dealing among their adversaries. The real failure of the prosecution of Addison's old friend, Sacheverell, completed the ruin of the Whigs; and in August, 1710, an entire revolution in the ministry had been completed. The Tory administration which succeeded kept its place till the queen's death in 1714, and Addison was thus left to devote four of the best years of his life, from his thirty-ninth year to his forty-third, to occupations less lucrative than those in which his time had recently been frittered away, but much more conducive to the extension of his own fame, and to the benefit of English literature.

Soon after the fall of the ministry, he contributed five numbers to the *Whig Examiner*, a paper set up in opposition to the Tory periodical of the same name, and afterwards became the vehicle of Swift's most vehement invectives against the party he had once belonged to. These are certainly the most ill-natured of Addison's writings, but they are neither lively nor vigorous. There is more spirit in his allegorical pamphlet, the *Trial and Conviction of Count Tariff*.

But from the autumn of 1710 till the end of 1714 his principal employment was the composition of his celebrated Periodical Essays. The honor of inventing the plan of such compositions, as well as that of first carrying the idea into execution, belongs to Richard Steele, who had been a school-fellow of Addison at the Charterhouse, continued to be on intimate terms with him afterwards, and attached himself with his characteristic ardor to the same political party. When, in April 1709, Steele published the first number of the *Tatler*, Addison was in Dublin, and knew nothing of the design. He began to furnish essays in a few weeks, assisted occasionally while he held office, and afterwards wrote oftener than Steele himself. He thus contributed in all, if his literary executor selected his contributions correctly, more than 60 of the 271 essays which the work contains.

The *Tatler* was dropped at the beginning of 1711, but only to be followed by the *Spectator*, which was begun on the 1st day of March, and appeared every week-day till the 6th day of December, 1712. It had then completed the 555 numbers usually collected in the first seven volumes.

On the cessation of the *Spectator* Steele set on foot the *Guardian*, which, started in March 1713, came to an end in October, with its 175th number. To this series Addison gave 53 papers, being a very frequent writer during the latter half of its progress. None of his essays here aim so high as the best of those in the *Spectator*; but he often exhibits both his cheerful and well-balanced humor and his earnest desire to inculcate sound principles of literary judgment.

In April 1713 Addison brought on the stage, very reluctantly, as we are assured, and can easily believe, his tragedy of *Cato*. Its success was dazzling; but this issue was mainly owing to the concern which the politicians took in the exhibition. The Whigs hailed it as a brilliant manifesto in favor of constitutional freedom. The Tories echoed the applause, to show themselves enemies of despotism, and professed to find in Julius Cæsar a parallel to the formidable Marlborough.

The literary career of Addison might almost be held as closed soon after the death of Queen Anne, which occurred in August 1714, when he had lately completed his 42nd year. His own life extended only five years longer; and this closing portion of it offers little that is pleasing or instructive. We see him attaining the summit of his ambition, only to totter for a little and sink into an early grave.

In August 1716, when he had completed his 44th year, Addison married the Countess-Dowager of Warwick. The countess is said to have been proud as well as violent, and to have supposed that, in contracting the alliance, she conferred honor instead of receiving it. Addison died June 17, 1719.

ADDISON, THOMAS, born at Newcastle, England, in 1793, graduated in medicine at Edinburgh and settled in London, where he became eminent as a clinical lecturer and a painstaking investigator. His most important researches were on pneumonia, phthisis, and diseases of the supra-renal capsules, and he wrote extensively on the complaint of the latter organs known as "Addison's disease." He died June 29, 1860.

ADEL, or SOMAULI, on extensive tract of country stretching eastward from the neighborhood of Tajurrah to Cape Guardafui, between 43° and 51° E. long., with a breadth not accurately ascertained.

ADELAAR, CORT SIVARTSEN, surnamed the Eagle, a famous naval commander, was born at Brevig in Norway in 1622. At the age of fifteen he became a cadet in the Dutch fleet under Van Tromp, and after a few years entered the service of the Venetian Republic, and died in the Danish service in 1675.

ADELAIDE, the capital of the British colony of South Australia and of the county of the same name, situated on the Torrens, seven miles from Port Adelaide, with which it is connected by railway. The river, which is spanned at this point by several bridges, divides the city into two parts—North Adelaide, the smaller of the two, but containing the chief private houses, occupying a gentle slope on the right bank; and South Adelaide, the commercial centre of the town, lying on a very level plain on the left. The chief manufactures are woolen, starch, soap, beer, flour, leather, earthenware, and iron goods. There is a good retail trade in European produce; and in the vicinity are iron and copper mines. Population, (1901), 160,691.

PORT ADELAIDE is situated in a low marshy position, on a small inlet of the Gulf of St. Vincent. Its harbor

is safe and commodious; but a bar at the mouth, where the depth of water varies with the tide from 8 to 16 feet, prevents large vessels from entering. It is a free port, and has good wharfs and warehouse accommodations. Population, about 4000.

ADELSBERG, a market town of Austria, in the province of Carniola, 26 miles S.W. of Laibach, and about the same distance E. of Trieste. Pop., 2000.

ADELUNG, FRIEDRICH VON, a distinguished philologist, nephew of John Christoph Adelung, was born at Stettin on the 25th of February 1768. After studying philosophy and jurisprudence at Leipsic he traveled in Italy. Thence he went to Russia and became tutor in the imperial family. In 1824 he was made director of the St. Petersburg Oriental Institute, and in 1825 president of the Academy of Sciences. He died in 1843.

ADELUNG, JOHANN CHRISTOPH, a very eminent German grammarian, philologist, and general scholar, was born at Spantekow, in Pomerania, on the 8th of August 1732, and educated at the public schools of Anclam and Klosterbergen, and the university of Halle. In the year 1759 he was appointed professor at the gymnasium of Erfurt, but relinquished this situation two years after, and went to reside in a private capacity at Leipsic, where he continued to devote himself for a long period to the cultivation of letters, and particularly to those extensive and laborious philological researches which proved so useful to the language and literature of his native country. The writings of Adelung are very voluminous, and there is not one of them, perhaps, which does not exhibit some proofs of the genius, industry and erudition of the author. But although his pen was usefully employed upon a variety of subjects in different departments of literature and science, it is to his philological labors that he is principally indebted for his great reputation; and no man ever devoted himself with more zeal and assiduity, or with greater success, to the improvement of his native language. His German dictionary has been generally regarded as superior to the English one of Johnson, and certainly far surpasses it in etymology. Indeed, the patient spirit of investigation which Adelung possessed in so remarkable a degree, together with his intimate knowledge of the ancient history and progressive revolutions of the different dialects on which the modern German is based, peculiarly qualified him for the duties of a lexicographer. No man before Jacob Grimm did so much for the language of Germany. Shortly before his death he issued the very learned work, at which he had been laboring quietly for years, entitled *Mithridates; or, a General History of Languages, with the Lord's Prayer, as a specimen, in nearly five hundred languages and dialects*.

ADEN, a town and seaport of Yemen, in Arabia, belonging to Great Britain, situated on a peninsula of the same name, 100 miles east of the strait of Bab-el-Mandeb. The peninsula of Aden consists chiefly of a mass of barren and desolate volcanic rocks, extending five miles from east to west, and three from its northern shore to Ras Sanailah or Cape Aden, its most southerly point; it is connected with the main land by a neck of flat, sandy ground, only a few feet high; and its greatest elevation is Jebel Shamshan, 1776 feet above the level of the sea. The town is built on the eastern coast, in what is probably the crater of an extinct volcano, and is surrounded by precipitous rocks, that form an admirable natural defense. Aden early became the chief entrepôt of the trade between Europe and Asia. Population, (1901), 41,222.

ADERNO, a city in Sicily, in the province of Catania, near the foot of Mount Etna, 17 miles N.W. of Catania. It is built on the site of the ancient *Adranum*, portions of the massive walls of which are still

visible, and numerous Roman sepulchres have been found in the vicinity. Population 16,000.

ADERSBACH ROCKS, a remarkable group of isolated columnar rocks in a valley of the Riesengebänge, on the frontier of Bohemia and Prussian Silesia, 9 miles W.N.W. of Braunau.

ADHESION, a term used to denote the physical force in virtue of which one body or substance remains attached to the surface of another with which it has been brought in contact. It is to be distinguished from *cohesion*, which is the mutual attraction that the particles of the same body exert on each other; and it differs from *chemical attraction* or *affinity*, since the properties of the substances it affects remain unchanged after it takes place. It is a force that the molecules of the adhering bodies exert on each other, and must not be confounded with a contact which is due to mere mechanical pressure, such as that which a piece of caoutchouc tubing exerts by its elasticity on a body that distends it. The phenomena of **CAPILLARY ATTRACTION** (*q.v.*) depend on adhesion. Sometimes, when a solid and a liquid are brought into contact, the adhesive force overcomes the cohesion of the particles of the solid, so that it loses its solid form, and is dissolved or held in solution. To a looser kind of adhesion, whereby one body is prevented from moving smoothly on the surface of another, we give the name of *friction*. The force of this increases with pressure, which may be the effect of gravitation or the result of mechanical appliances. The principle of the process of plating, gilding, &c., is similar to this. The adhesive force of cement, &c., is sometimes very great. Again, air and other gases adhere to solids. A dry needle, placed carefully on the surface of still water, will float, resting on a cushion of air; and when thermometers are filled with mercury, the liquid has to be boiled in them to expel the air that adheres to the glass.

ADIAPHORISTS, a name applied to Melancthon and his supporters in a controversy which arose out of the so-called Leipsic Interim (1548), and raged until 1555. In 1547 Charles V. had drawn up the Augsburg Interim, with a view to provide for the temporary government of the Church until a general council could be called. This gave great dissatisfaction both to the advanced and to the more moderate reformers; and the object of Melancthon's Leipsic Interim was to reconcile all parties, if possible, by declaring that certain rites and observances of the Roman Catholic Church and the jurisdiction of the Roman Catholic bishops being *adiaphora* (things indifferent), might be lawfully recognized.

ADIGE (German, *Etsch*), the ancient *Athesis*, a large river of Italy, formed by several rivulets which rise in the Rhetian Alps, and unite near Glarus. It is navigable from the heart of the Tyrol to the sea, and has in Lombardy a breadth of 200 yards and a depth of from 10 to 16 feet, but the strength of the current renders its navigation very difficult, and lessens its value as a means of transit between Germany and Northern Italy. The Adige has a course of about 220 miles.

ADIPOCERE (from *adepts*, fat, and *cera*, wax), a substance into which animal matter is sometimes converted, deriving its name from the resemblance it bears to both fat and wax. When the Cemetery of the Innocents at Paris was removed in 1786-87, great masses of this substance were found where the coffins containing the dead bodies had been placed very closely together. At the bottom of the coffin, in these cases, there appeared, loosely enveloped in linen, a shapeless mass, of a dingy white color, flattened as though it had undergone great pressure. The whole body had been converted into this **fatty matter**, except the bones, which remained, but were

extremely brittle. A similar substance, found in peat, is known as *bog-butter*.

ADIPOSE (*adepts*, fat), a term in *Anatomy*, signifying fatty; as adipose tissue, adipose cell, &c.

ADIRONDACK MOUNTAINS, a group of mountains in the N. of the State of New York, lying between Lakes Champlain and Ontario. They rise from an extensive plateau about 2000 feet above the level of the sea, and are chiefly of granite formation. Mount Marcy, the highest summit, has an altitude of 5337 feet, and others of the group are from 4000 to 5000 feet.

ADIT (from *adire*, to go to), a passage or door. The doors of porticoes in ancient theatres were called adits. In mines the name is given to a gallery or passage, nearly horizontal, by which water is carried off. Ores also are sometimes removed by the adit. Some works of this kind are of great magnitude.

ADJUDICATION, in law, is used generally in the United States to describe the act or process of trying and determining a case judicially.

ADJUSTMENT, in *Commerce*, the settlement of a loss incurred at sea on insured goods. If the policy be what is called an *open one*, and the loss of the goods be total, the insurer must pay for them at the value of prime cost, which includes not only the invoice price of the goods, but all duties paid, the premium of insurance, and all expenses incurred on them when put on board.

ADJUTAGE, a short tube or nozzle, inserted in an orifice, by means of which liquids flow from a vessel more freely.

ADJUTANT, a military officer whose duty it is to assist the commanding officer of a regiment or battalion. Every battalion of infantry, regiment of cavalry, and brigade of artillery, has an adjutant, who keeps the regimental books, records, and correspondence; acts as the commanding officer's representative in matters of regimental detail; superintends the drill of recruits; keeps the roster (*i.e.*, register of order of service) for all duties; details the guards, pickets, detachments, &c., that are furnished by the regiment; and is responsible for the receipt of the daily divisional or brigade order from the superior staff-officer, and the preparation and issue of regimental orders. The *Adjutant-General* is the staff-officer specially charged with all matters relating to the discipline and drill of the army.

ADJUTANT, the *Ciconia Argala*, or *Leptoptilos Argala*, a species of stork found in tropical India. It is of great size, sometimes six or seven feet in height, the body and legs bearing nearly the same proportions as in the common stork.

ADJYGURH, a town and fort of India in the presidency of Bengal, 130 miles S.W. of Allahabad. Population, 5000.

AD LIBITUM, at pleasure. In music the term implies that the part so marked may be performed according to the taste of the performer, and not necessarily in strict time. It may mean, also, that parts for particular instruments may be played or left out at discretion.

ADMINISTRATOR, in law, the person to whom the judge of the court of probate commits the administration of the goods of a person deceased, in default of an executor. The origin of administrators is derived from the civil law.

ADMINISTRATOR, a person legally employed to act for another whom the law presumes incapable of acting for himself, as a father for a pupil child.

ADMIRAL, a great officer or magistrate, who has the government of a navy and the hearing of all maritime causes. It is the highest rank in the British navy, but is not at present held by any officer in this country.

There can be little doubt of the Asiatic origin of the name given to this officer, which does not appear to have been known in the language of Europe before the time of the Holy Wars. *Amir*, in Arabic, is a chief or commander of forces; it is the same word as *ameer* of the peninsula of India.

ADMIRALTY CHARTS. These useful aids to navigation are constructed in the hydrographic department of the British Admiralty, by specially-appointed surveyors and draughtsmen, and they are issued to the public by order of the lords commissioners of the admiralty. Accompanying the charts there are books of sailing directions, tables, and lists of lights. Similar charts to those of the British Admiralty are issued by the United States Coast and Geodetic Survey, as well as by the Russian and French governments. The superintendent of the Coast Survey issues an annual report showing the progress of the survey, and containing much valuable information.

ADMIRALTY, HIGH COURT OF, the English court of law having jurisdiction in nearly all matters connected with the British marine. It had formerly a criminal as well as civil jurisdiction in time of peace, but this prerogative is now exercised only on special occasions.

ADMIRALTY ISLAND, an island belonging to the United States, about ninety miles long from north to south, and twenty-five miles broad, lying between King George III. Archipelago and South Alaska, in 58° N. lat., 134° W. long.

ADMIRALTY ISLANDS, a group of forty islands lying northeast of New Guinea, between 2° and 3° S. lat., and 146° 18' and 147° 46' E. lon.

ADOBE, sun-dried brick, in common use in Arizona, Mexico, and Central America.

ADOLPHUS, JOHN, historian and barrister, was born in London on the 7th of August, 1768. *The History of England from the Accession of George III. to 1783*, which he published in 1802, was favorably noticed in the *Edinburgh Review* for its impartiality and accuracy. A new and enlarged edition of this work, in eight volumes, in preparation, but only seven volumes were completed when the author died, July 16, 1845.

ADOLPHUS, JOHN LEYCESTER, son of the above, also a distinguished barrister (died 1862), was the first to pierce the mask of the author of *Waverley*, in letters addressed to Richard Heber, which he published in 1821.

ADONAI, a Hebrew name for the Supreme Being.

ADONIS, according to some authors, the son of Theias, king of Assyria, and his daughter Smyrna [Myrrha], was the favorite of Venus. He was fond of hunting; and Venus often warned him not to attack the larger wild beasts; but neglecting the advice, he was killed by a wild boar he had rashly wounded. Venus was inconsolable, and turned him into a flower of a blood color, supposed by some to be an anemone. Adonis had to spend half the year in the lower regions, but during the other half he was permitted to revisit the upper world, and pass the time with Venus.

ADONIS, in Ancient Geography, a small river rising in Mount Lebanon, and falling into the sea at Byblus.

ADONIS, a genus of ranunculaceous plants, known commonly by the names of Pheasant's Eye and *Flos Adonis*.

ADOPTIAN CONTROVERSY, a controversy relating to the sonship of Christ, raised in Spain by Elipandus, archbishop of Toledo, and Felix, bishop of Urgel, towards the close of the 8th century. By a modification of the doctrine of Nestorius they maintained that Christ was really the Son of God in his divine nature alone, and that in his human nature he was only the son of God by adoption. A friendly letter from Alcuin, and a

controversial pamphlet, to which Felix replied, were followed by the sending of several commissions of clergy to Spain to endeavor to put down the heresy. Archbishop Leidrad of Lyons being on one of these commissions, persuaded Felix to appear before a synod at Aix-la-Chapelle in 799. There, after six days' disputing with Alcuin, he again recanted his heresy. The rest of his life was spent under the supervision of the archbishop at Lyons, where he died in 816.

ADOPTION, the act by which the relations of paternity and filiation are recognized as legally existing between persons not so related by nature. Cases of adoption were very frequent among the Greeks and Romans, and the custom was accordingly very strictly regulated in their laws. In Athens the power of adoption was allowed to all citizens who were of sound mind, and who possessed no male offspring of their own, and it could be exercised either during lifetime or by testament. The person adopted, who required to be himself a citizen, was enrolled in the family and *demos* of the adoptive father, whose name, however, he did not necessarily assume. Among the Romans the existence of the *patria potestas* gave a peculiar significance to the custom of adoption. The motive to the act was not so generally childlessness, or the gratification of affection, as the desire to acquire those civil and agnate rights which were found on the *patria potestas*. It was necessary, however, that the adopter should have no children of his own, and that he should be of such an age as to preclude reasonable expectation of any being born to him. Another limitation as to age was disposed by the maxim *adoptio imitatur naturam*, which required the adoptive father to be at least eighteen years older than the adopted children. Adoption is regulated in the United States by State statutes. Generally it is accomplished by mutual obligations, assumed in the manner prescribed by law, and after the appearance of the parties in a court of record. The matter of adoption is usually brought before the county or probate judge, who satisfies himself that the adopter will treat the infant properly, and possesses sufficient means to maintain and educate it. In such cases the relation of parent and child is established.

ADORATION (from *os, oris*, the mouth, or from *oro*, to pray), an act of homage or worship which, among the Romans, was performed by raising the hand to the mouth, kissing it, and then waving it in the direction of the adored object. Adoration is applied in the court of Rome to the ceremony of kissing the Pope's foot, a custom which is said to have been introduced by the popes after the example of the Emperor Diocletian. In the Romish Church a distinction is made between *Latria*, a worship due to God alone, and *Dulia* or *Hyperdulia*, the adoration paid to the Virgin, saints, martyrs, crucifixes, the host, &c.

ADOUR, the ancient *Aturus*, a river of France which rises near Barège, in the department of Upper Pyrenees, and, flowing first northward, then, with a circuit to the west, passes through the departments of Gers and Landes, and falls into the Bay of Biscay, 3 miles below Bayonne.

ADOWA, the capital of Tigré, in Abyssinia, is situated in 14° 12' N. lat., 39° 3' E. long., on the left bank of the River Hasam, 145 miles N.E. of Gondar. Population, about 6000.

ADRA, the ancient *Abdera*, a seaport of Spain, on the Mediterranean, in the province of Almeria, 60 miles S.E. of Grenada. Population, 7400.

ADRASTUS, in Legendary History, was the son of Talaus, king of Argos, and Lysianassa, daughter of Polybus, king of Sicyon. Being driven from Argos by Amphiaras, Adrastus repaired to Sicyon, where he became king on the death of Polybus. After a time he

was reconciled to Amphiarus, to whom he gave his sister in marriage, returned to Argos, and occupied the throne. He acquired great honor in the famous war against Thebes, which he undertook for the restoration of his son-in-law Polynices, who had been deprived of his rights by his brother Eteocles, notwithstanding the agreement between them. The death of his son affected Adrastus so much that he died of grief at Megara, as he was leading back his victorious army.

ADRIA, a city of Italy, in the province of Rovigo, between the rivers Po and Adige. It is a place of great antiquity, and was at an early period a seaport of such importance and celebrity as to give name to the sea on which it stood. The population of Adria is 10,000.

ADRIA, in St. Paul's time meant all that part of the Mediterranean between Crete and Sicily. This fact is of importance, as it relieves us from the necessity of finding the island of Melita, on which Paul was shipwrecked, in the present Adriatic Gulf.

ADRIAN, capital of Lenawee co., Michigan, situated on a branch of the Raisin river, and on the Michigan Southern Railway, 73 miles W.S.W. of Detroit. Adrian is the centre of trade for the district, which is chiefly grain-producing. Pop. (1900), 9,654.

ADRIAN, PUBLIUS ÆLIUS, Roman emperor. See HADRIAN and ROMAN HISTORY.

ADRIAN (sometimes written HADRIAN) was the name of six popes:—

ADRIAN I., son of Theodore, a Roman nobleman, occupied the pontifical chair from 772 to 795. Soon after his accession the territory that had been bestowed on the popes by Pepin was invaded by Desiderius, king of the Longobards, and Adrian found it necessary to invoke the aid of Charlemagne, who entered Italy with a large army, and repelled the enemy. The pope acknowledged the obligation by conferring upon the emperor the title of Patrician of Rome, and Charlemagne made a fresh grant of the territories originally bestowed by his father, with the addition of Ancona and Benevento. The friendly relations thus established between pope and emperor continued unbroken, though a serious difference arose between them on the question of the worship of images, to which Charlemagne and the Gallican Church were strongly opposed, while Adrian favored the views of the Eastern Church, and approved the decree of the Council of Nicaea (787), confirming the practice and excommunicating the iconoclasts. It was in connection with this controversy that Charlemagne wrote the so-called *Libri Carolini*, to which Adrian replied by letter, anathematizing all who refused to worship the images of Christ, or the Virgin, or saints. Notwithstanding this, a synod, held at Frankfort in 794, anew condemned the practice, and the dispute remained unsettled at Adrian's death.

ADRIAN II., born at Rome, became pope in 867, at the age of seventy-six. He faithfully adhered to the ambitious policy of his immediate predecessor, Nicholas I., and used every means to extend his authority. His persistent endeavors to induce Charles the Bald to resign the kingdom of Lorraine to the emperor were unsuccessful. His arrogant measures were, however, the immediate occasion of the schism between the Greek and Latin churches. Adrian had himself been married, but put away his wife on ascending the papal throne, and a council called by him at Worms in 868 decreed the celibacy of the clergy. He died in 872.

ADRIAN III., born at Rome, succeeded Martin II. in 884, and died in 885 on a journey to Worms.

ADRIAN IV., whose name was Nicholas Breakspere, was born before 1100 A.D. at Langley, near St. Albans, in Hertfordshire, and is the only Englishman who has occupied the papal chair. His merit became known to

Pope Eugenius III., who created him cardinal-bishop of Alba in 1146, and sent him two years later as his legate to Denmark and Norway. On this mission he converted many of the inhabitants to Christianity, and erected Upsal into an archiepiscopal see. Soon after his return to Rome, Anastasius, successor of Eugenius, died, and Nicholas was unanimously chosen pope, against his own inclination, in Nov. 1154. On hearing of the election, Henry II. of England sent the abbot of St. Albans and three bishops to Rome with his congratulations, which Adrian acknowledged by granting considerable privileges to the monastery of St. Albans, including exemption from all episcopal jurisdiction except that of Rome. The bestowal by Adrian of the sovereignty of Ireland upon the English monarch was a practical assertion of the papal claim to dispose of kingdoms. The act, besides facilitating and hastening the subjection of Ireland to England, was also the means of inducing Henry to yield the long-contested point of lay investiture to ecclesiastical offices. The beginning of Adrian's pontificate was signalized by the energetic attempts of the Roman people to recover their ancient liberty under the consuls, but the pope took strong measures to maintain his authority, compelling the magistrates to abdicate, laying the city under an interdict, and procuring the execution of Arnold of Brescia (1155). With Adrian commenced the long and bitter conflict between the papal power and the house of Hohenstaufen which ended in the humiliation of the latter. A letter addressed by the pope to Frederick and the German bishops in 1157 asserted that the emperor held his dominions as a *beneficium*. The expression, being interpreted as denoting feudal tenure, stirred up the fiercest indignation of Frederick and the Germans, and though explanations were afterwards given with the view of showing that the word had not been used in an offensive sense, the breach could not be healed. Adrian was about to pronounce the sentence of excommunication upon Frederick when he died at Anagni on the 1st Sept. 1159.

ADRIAN V., a Genoese, whose name was Ottobnio Fieschi, occupied the papal throne for only five weeks in 1276. When congratulated on his accession he replied in the well-known words, "I wish you had found me a healthy cardinal rather than a dying pope."

ADRIAN VI., born of humble parentage at Utrecht in 1459, studied at the university of Louvain, of which he became vice-chancellor. He was chosen by the Emperor Maximilian to be tutor to his grandson, the Archduke Charles, through whose interest as Charles V. he was afterwards raised to the papal throne. In 1517 he received the cardinal's hat from Leo X., and in 1519 he was made bishop of Tortosa. After the death of Ferdinand he was for a time regent of Spain. He was chosen pope Jan. 9, 1522. He died on the 14th September 1523. So little did the people care to conceal their joy at the event that they wrote on the door of his physician's house the words "the savior of his country."

ADRIAN, CARDINAL, was born at Corneto, in Tuscany, and studied at Rome. He was sent by Innocent VIII. as nuncio to Britain, to endeavor to reconcile James III. of Scotland and his subjects. On his return to Rome he became secretary to Pope Alexander VI., who employed him in various missions, and subsequently invested him with the purple. It was Adrian in particular that Alexander is said to have meant to poison in order that he might seize on his great wealth, when, as is generally reported, he fell a victim to his own wickedness. Not long after the elevation of Leo X. to the papal chair he was implicated in the conspiracy of Cardinal Petrucci against that pontiff. He confessed his guilt; and pardon being offered only on condition of his

payment of a fine of 25,000 ducats, he resolved to fly from Rome. It is supposed that he was murdered by a domestic who coveted his wealth.

ADRIANI, GIOVANNI BATTISTA, born of a patrician family of Florence about 1511, was for thirty years professor of rhetoric at the university. He wrote a history of his own times, from 1536 to 1574, in Italian, which is generally, but according to Brunet erroneously, considered a continuation of Guicciardini. He died at Florence in 1579.

ADRIANOPOLE (called by the Turks EDRENEH), a city of European Turkey, in the province of Rumelia, 137 miles W.N.W. of Constantinople; $41^{\circ} 41'$ N. lat., $26^{\circ} 35'$ E. long. It is pleasantly situated partly on a hill and partly on the banks of the Tundja, near its confluence with the Maritza. Next to Constantinople, Adrianople is the most important city of the empire. It is the seat of a bishop of the Greek Church. Adrianople was called Uskadama previous to the time of the Emperor Hadrian, who improved and embellished the town, and changed its name to Hadrianopolis. In 1360 it was taken by the Turks, who, from 1366 till 1453, when they got possession of Constantinople, made it the seat of their government. In the campaign of 1829 Adrianople surrendered to the Russians without making any resistance, but was restored after the treaty of peace signed the same year. Pop. of province, 1,006,500; of city, 81,000.

ADRIATIC SEA, the *Adriaticum Mare* of the ancients, is an arm of the Mediterranean which separates Italy from Trieste, Croatia, Dalmatia, and Albania. It extends from 40° to $45^{\circ} 50'$ N. lat. in a N.W. direction. Its extreme north-west portion forms the Gulf of Venice, and on the least side are the gulfs of Trieste, Fiume, Cattaro, and Drino. Its greatest length is 450 miles, its mean breadth 90 miles, and its depth varies from 12 to 22 fathoms. The western or Italian coasts are generally low and marshy; but the eastern shores are steep and rocky, and the abounding creeks and inlets, with the numerous islands, afford to the mariner many safe natural harbors.

ADULE or ADULIS, a town on the Red Sea. See ZULLA.

ADULLAM, in *Scripture Geography*, a city in the plain country of the tribe of Judah.

ADULTERATION, the act of debasing a pure or genuine commodity for pecuniary profit, by adding to it an inferior or spurious article, or by taking from it one or more of its constituents. The statutes against adulteration in the United States are of a purely local character, and vary with locality. The following applies to British legislation only: The objects of adulteration are fourfold, namely, to increase the bulk or weight of the article, to improve its appearance, to give it a false strength, or to rob it of its most valuable constituents. All these adulterations are manifestly of a designedly fraudulent character, and are therefore properly the subjects of judicial inquiry; but there may be accidental corruptions and adulterations of a commodity, arising from natural or unavoidable causes, as when darnel or ergot become mixed with grain in the fields of the slovenly farmer, or when an article becomes changed and deteriorated from spontaneous decay, or when mineral matters or other impurities are accidentally derived from the machinery or vessels in which the thing is prepared or kept. The recognition of such impurities, and the tracing of them to their source, is of prime importance in pursuing a charge of adulteration. Few articles of commerce, however, are exempt from fraudulent adulteration, and the practice of it has grown with the competition of trade, and the removal of those wholesome restrictions which in former times were so energetically opposed to

all kinds of dishonest dealings; all large cities had their corporate regulations for supervising and governing every description of trade and manufacture. The excise, too, including the customs, had until recently control over the quality of all excisable articles; and, although the prime object of this was to protect the revenue of the country, yet it also served to prevent adulteration. As far back as the reign of John (1203) there was a proclamation throughout England for enforcing the legal obligations of assize as regards bread; and in the following reign the statute (51 Hen. III. stat. 6) entitled the Pillory and Tumbrel, was framed for the express purpose of protecting the public from the dishonest dealings of bakers, vintners, brewers, butchers, and others. This statute is deserving of notice as the first in which the adulteration of human food is specially noticed and prohibited; and it seems to have been enforced with more or less rigor until the time of Anne, when it was repealed. According to *Liber Albus*, it was strictly observed in the days of Edward I., for it states that, "if any default shall be found in the bread of a baker in the city, the first time, let him be drawn upon a hurdle from the Guildhall to his own house through the great street where there be most people assembled, and through the great streets which are most dirty, with the faulty loaf hanging from his neck; if a second time he shall be found committing the same offence, let him be drawn from the Guildhall through the great street of Cheepe, in the manner aforesaid, to the pillory, and let him be put upon the pillory, and remain there at least one hour in the day; and the third time that such default shall be found, he shall be drawn, and the oven shall be pulled down, and the baker made to forswear the trade in the city for ever." Vintners, spicers, grocers, butchers, regrators, and others, were subject to the like punishment for dishonesty in their commercial dealings—it being thought that the pillory, by appealing to the sense of shame, was far more deterrent of such crimes than fine or imprisonment. But all this has given way to the force of free trade, and now the practice of adulteration has become an art, in which the knowledge of science and the ingenuity of trade are freely exercised. In the year 1872, an Act was passed, entitled An Act to amend the laws for the Prevention of Adulteration of Food, Drink, and Drugs. The main features of this Act are the following:—Local authorities in England, Scotland, and Ireland are bound to appoint analysts with competent medical, chemical, and microscopical knowledge. They must also appoint officers or inspectors to purchase articles of food, drink, and drugs within their respective districts, and take them to the analyst for examination. On receiving a certificate from the analyst, stating that any article is adulterated, the inspector must take the necessary legal proceedings for the purpose of bringing the offender to justice. The penalty on conviction of mixing anything whatever with a drug, with the view of adulterating it, or of mixing any injurious or poisonous ingredient with any article of food or drink, is a sum not exceeding fifty pounds, together with the costs; and for the second offence he shall be guilty of a misdemeanor, and be imprisoned for a period not exceeding six calendar months with hard labor. The adulteration of intoxicating liquors is provided for by the Licensing Act 1872, and in this Act there is a schedule of substances, called "*Deleterious Ingredients*," which are considered to be adulterations. The penalties for adulteration are very severe, leaving it to the magistrate either to inflict a heavy fine or to send the offender to prison.

Adulteration in other countries is strictly prohibited under penal obligations. The Prussian penal code pro-

vides that any person selling adulterated or spoiled goods shall be liable to a penalty up to fifty dollars, or imprisonment for six weeks, with confiscation of goods; and it is not necessary to prove that the seller was aware of the adulteration. In Holland, the Dutch law is very similar to the code Napoleon, and inflicts a punishment of imprisonment for from six days to two years, with a fine of from 16 to 600 francs. The adulteration of bread with copperas or sulphate of zinc is dealt with by imprisonment of from two to five years, and a fine of from 200 to 500 florins. In Paris, malpractices connected with the adulteration of food are investigated by the Conseil de Salubrité and punished.

Adulterations of Milk.—This is commonly effected by the addition of water—technically termed Simpson; and it is known by the appearance of the milk, the specific gravity of it, the quantity of cream which rises, and the chemical composition of the milk. Good milk has a rich appearance, and a full pleasant taste. Its specific gravity ranges from 1029 (water being 1000) to 1032—the average being 1030. If, therefore, the density of milk is above 1030, other conditions corresponding, the inference is that the sample is unusually good. Between 1028 and 1030 it is most probably genuine. At from 1026 to 1028 it is of doubtful quality, and below that, unless the amount of cream is enormously large, the sample is not genuine. An instrument, called a *galactometer*, has been constructed to show the specific gravity of milk at a glance; but it must always be remembered that while the addition of water tends to lower the gravity of milk, so also does the presence of much cream, and therefore a sample of skimmed milk may show a high gravity even when diluted with water. The percentage quantity of cream is ascertained by means of an instrument called a *lactometer*.

Coffee has from very early times been the subject of sophistication. As far back as 1725, the Act 2 Geo. I. c. 30, took cognizance of the practice, and rendered it penal. In 1803 it was the object of very decisive measures, for by 43 Geo. III. c. 129, the officers of excise were empowered to search for, and to seize any burnt, scorched, or roasted peas, beans, or other grains or vegetable substance prepared in imitation of coffee; and any person manufacturing or selling the same was liable to a penalty of £100; gradually, however, it was found that use of torrefied vegetables in lieu of coffee, was becoming general in spite of these restrictions, and, therefore, in 1822, the Legislature thought it expedient to allow the manufacture and sale of scorched or roasted corn, peas, beans, or turnips, by persons who were not dealers or sellers of coffee or cocoa, provided the same was sold under license in a whole or unground condition, and in its proper name. At that time the use of chicory was not generally known in England, although it had long before been introduced into France as a substitute for coffee. It was also used in Belgium and the Netherlands, so that travellers who visited Paris, Brussels, or Amsterdam, became acquainted with the substitute, and gradually acquired a taste for it. Even chicory itself is now the subject of adulteration with roasted corn, beans, lupin seeds, acorns, horse-chestnuts, peas, pulse, mustard husks, coffee husks, and even spent coffee, besides various roots, as carrots, parsnips, mangel-wurzel, beet-root, dandelion, etc. It is even said that spent tan and dried bullocks' livers have been employed for the purpose. The tests for these adulterations are the appearances presented by the tissues of the various vegetables when examined under the microscope, and by the fact that infusion of chicory does not become discolored when it is treated with iodine, as it contains no starchy matters.

Tea.—Formerly when the supply of tea to Great

Britain was entirely under the control of the East India Company, the adulteration of it in China was rarely practiced, as every shipment of it was carefully examined by experienced officers at Canton, who rejected all teas of spurious or doubtful character. At that time, therefore, the adulteration of tea was carried on after it was imported into England and there were many legislative enactments prohibiting the practice. By the Act 2 Geo. I. c. 3, every tea dealer was subject to a penalty of £100, if he was convicted of counterfeiting, altering, fabricating, or manufacturing tea, or mixing it with other leaves. Later still, the statutes of 4 Geo. II. c. 14, and 17 Geo. III. c. 29, and 4 Geo. IV. c. 14, dealt more precisely with the subject, and imposed other penalties. At that time the adulterations of tea were effected in a wholesale manner; for according to Mr. Phillips, of the Inland Revenue Office, there were in London alone, in 1843, as many as eight manufactories in which the exhausted leaves, obtained from hotels, coffee-houses, and elsewhere, were redried, and faced with rose-pink and blacklead, in imitation of genuine tea. More recently, however, the adulteration of tea has been practiced by the Chinese, who find no difficulty in disposing of any kind of spurious tea to English merchants at Canton and Shanghai, who ship it to other countries and lodge it in the bonded warehouses with all the formalities of an honorable transaction, knowing that the difficulties of convicting them under the Adulteration of Food Acts and Nuisances Removal Acts are almost insurmountable; for, in the first place, the local sanitary authorities have no means of obtaining direct information of the existence of unsound or spurious tea, or other article of food or drink in bonded warehouses; and secondly, if such information reaches them indirectly, they have no legal right of entry for the purpose of examining the tea and taking samples. But besides these, there are the difficulties of proving the ownership of the article, and the guilty knowledge of the broker who sells it. In illustration of this, we may refer to the proceedings of the sanitary authorities of the city of London in their endeavor to suppress the importation and sale of spurious tea. In the month of March, 1870, Dr. Letheby, the food analyst for the city, reported that a large quantity of spurious tea had arrived in London from China, and was lodged in the bonded warehouses of the city. The adulterations practiced by the Chinese are numerous; exhausted tea is redried and glazed in a very deceptive manner. Millions of pounds of leaves of different plants, other than tea, are gathered and mixed with it. Mineral matters too, in the form of china clay, fine sand, and iron filings, are ingeniously incorporated with the leaf before curling, so that as much as from 20 to 40 per cent. of impurity is thus mixed with it.

Cocoa in its natural state contains so much fatty matter (amounting to rather more than half its weight), that it has long been the practice to reduce it by means of sugar or farinaceous substances. The first of these preparations is called chocolate, and the latter is known by such names as granulated, flake, rock, soluble cocoa, &c. In some cases the mixture is adulterated with mineral matters, as oxide of iron, to give color. These adulterations are recognized by the appearance and taste of the preparation, by its microscopic characters, by the color and reaction of its solution, and by the proportions of fat and mineral matters in it.

Bread.—Especial care has been taken at all times to protect the public from the dishonest dealing of bakers. The assize of bread, for example, is a very ancient institution; for it was the subject of a proclamation in 1202, and it was the chief matter referred to in the notable statute of the Pillory and Tumbrel already mentioned. At the present time, the chief adulterations

of bread are with alum or sulphate of copper for the purpose of giving solidity to the gluten of damaged or inferior flour, or with chalk or carbonate of soda to correct the acidity of such flour, or with boiled rice or potatoes to enable the bread to carry more water, and thus to produce a large number of loaves per sack of flour. In practice 100 lbs. of flour will make from 133 to 137 lbs. of bread, a good average being 136 lbs.; so that a sack of flour of 280 lbs. should yield 95 four-pound loaves. But the art of the baker is exercised to increase the number, and this is accomplished by hardening the gluten in the way already mentioned, or by means of a gummy mass of boiled rice, three or four pounds of which, when boiled for two or three hours in as many gallons of water, will make a sack of flour yield at least 100 four-pound loaves. The ash of bread will also furnish evidences of the presence of mineral impurities.

Flour and other Farinaceous Matters.—The tests for good flour are its sweetness and freedom from acidity and musty flavor. A given weight of the flour, say 500 grains, made into a stiff dough with water, and then carefully kneaded under a small stream of water, will yield a tough, elastic gluten, which, when baked in an oven, expands into a clean-looking ball of a rich brown color, that weighs, when perfectly dry, not less than 50 grains. Bad flour makes a ropy-looking gluten, which is very difficult of manipulation, and is of a dirty brown color when baked.

Fatty Matters and Oils are the subjects of frequent adulteration. Butter and lard, for example, are mixed with inferior fats, and with water, salt, and farina. Most of these impurities are seen when the sample of butter or lard is melted in a glass, and allowed to stand in a warm place for a few hours, when the pure fat will float as a transparent oil, while the water, salt, farina, &c., will subside to the bottom of the glass. Fresh butter generally contains a notable quantity of water, as from 12 to 13 per cent., and sometimes a little salt, and a trace of curd; but these should never exceed two per cent. in the aggregate. Foreign fats are recognised by the granular look of the butter, by its gritty feel, by its taste, and by its odor when warmed.

Oils are adulterated with inferior kinds, and the fraud is detected by means of the specific gravity of the oil, and its chemical reactions when tested upon a white plate with a drop of concentrated sulphuric acid—the color and its time of development being the indications of the quality of the oil.

Isinglass is often adulterated with gelatine, the fraud being ingeniously contrived so as to retain to a large extent the well-known characters of genuine isinglass; but it may be recognized in the following way: immersed in cold water, the shreds of genuine isinglass become white and opaque like cotton threads, and they swell equally in all directions, whereas those of gelatine become transparent and ribbon-like.

Sugar.—During the last ten or twelve years the manufacture of sugar from starch has been an important branch of industry. The product is sent into commerce under the names of glucose, saccharum, and British sugar; and although it is chiefly used for brewing purposes it is also employed for adulterating brown sugar, and for making confectionery, jams, marmalades and fruit jellies.

Mustard is generally so acrid and powerful in its flavor that it is commonly diluted with flour or other farinaceous matter, turmeric being added to improve its appearance.

Spices, as pepper, cinnamon, curry powder, ginger, cayenne, &c., are more or less the subjects of fraudulent adulteration, which can readily be detected by the microscope, and by an examination of the mineral constituents

Beer, Ale, and Porter.—The assize of ale is contemporaneous with that of bread, being described as the "*Assise Panis et Cerveisie*," in old documents. In the statute 51 Henry III. c. 16 (1266), they are spoken of as ancient and well-known institutions, the object of them being to regulate the quality and price of these articles. The officers appointed to determine the goodness of ale were called "ale conners," or "ale tasters" (*gustatores cervisie*), and were elected annually in the court-leet of each manor, and in the city of London at the ward-mote, according to the advice and assent of the alderman and other reputable men of the ward. As far back as the time of Anne there was a law prohibiting the use of *Coccus indicus* or any unwholesome ingredient in the brewing of beer, under severe penalties. The tests for the adulteration of beer, ale, and porter, are not easily applied except by a skilled chemist; but it may be said that the chief qualities of good beer are its density, sweetness, spirituousity, piquancy, flavor, and frothiness.

Malt.—The Excise do not permit malt to be adulterated with ungerminated grain; but it is very difficult to determine whether the presence of these grains is accidental or otherwise, as in some wet seasons when barley is badly stacked it will heat or become mouldy, and the grains will lose their vitality.

Wines and Spirits.—The denunciation in the Scripture against the use of mixed wine has reference, in all probability, to wines which were fortified or adulterated with stimulating and intoxicating herbs. In Great Britain measures were taken at a very early period to prevent the sale of unsound and unwholesome wine. In modern times the art of adulterating wine has been brought to great perfection; for it consists not merely in the blending of wines of different countries and vintages, but in the use of materials which are entirely foreign to the grape. Port wine, for example, is manufactured from Beni Carlos, Figueras, and red Cape, with a touch of Mountain to soften the mixture and give it richness—the body and flavor being produced by gum-dragon, and the color by "berry-dye," which is a preparation of German bilberries. To this is added the washings of brandy casks ("brandy cowe") and a little salt of tartar to form a crust. Sherry of the brown kind and of low price is mingled with Cape and cheap brandy, and is flavored with "brandy-cowe," sugar-candy, and bitter almonds. If the color be too high it is lowered by means of blood, and softness is imparted to it by gum-benzoin. Large quantities of what are called clarets are manufactured in England from inferior French wine and rough cider, the color being imparted to it by turnsol or cochineal. Madeira is produced from Vidonia with a little Mountain and Cape, to which are added bitter almonds and sugar. Common Sicilian wine is transformed into Tokay, Malaga, and Lachryma Christi Champagne is produced from rhubarb stalks, gooseberries and sugar, the product being largely consumed at balls, races, masquerades, and public dinners. Of late, too, since the investigations of Petiot, Thenard, Gall, Hussman, and others, the manufacture of wine from sugar and the refuse husk or mash of the grape has been largely practised, insomuch that a great part of the wine of France and Germany has ceased to be the juice of the grape at all. In point of fact, the processes of blending, softening, fortifying, sweetening, plastering, &c., &c., are carried on to such an extent that it is hardly possible to obtain a sample of genuine wine, even at first hand; and books are written on the subject, in which the plainest directions are given for the fabrication of every kind of wine, there being druggists called "brewers' druggists," who supply the agents of adulteration. These are as follows:—Elderberry, logwood, brazil-wood, red sandal-wood, cudbear, red beet-root, &c.,

for color; litharge, lime or carbonate of lime, carbonate of soda, and carbonate of potash, to correct acidity; catechu, logwood, sloe-leaves, and oak-bark, for astringency; sulphate of lime, gypsum, or Spanish earth, and alum for removing color; cane sugar for giving sweetness and body; glucose or starch sugar for artificial wine; alcohol for fortifying; and ether, especially acetic ether, for giving bouquet and flavor.

Tobacco and Snuff.—The adulteration of these articles is prohibited; manufacturers of tobacco and snuff being prohibited from using or having in their possession sugar, honey, molasses, treacle, leaves, herbs or plants, powdered wood, moss, weeds, sea-weeds, or any ground or unground roasted grain, chicory, lime, sand, amber, ochre or other earths, nor anything capable of being used to increase the weight of tobacco or snuff, under a penalty of £200—water alone being allowed in the manufacture of tobacco, and water, salt and alkaline salts, as well as lime, in the manufacture of snuffs, under a penalty of £300. These adulterations are recognized by drying the sample and noting the loss of weight, and by the amount and nature of the ash left on incineration. Foreign leaves, &c., are discovered by the aid of the microscope.

Among the adulterations which are practised for the purpose of improving the appearance of the article and giving it a false strength are the following: The addition of *alum* or *sulphate of copper* to bread, the facing of black tea with *black lead*, and of green with a mixture of *indigo* or *Prussian blue* with *turmeric* and *china clay*; the treatment of pickles and preserved fruits with a *salt of copper*, which has the property of mordanting and brightening the green coloring matter of vegetables. *Ferruginous earths* are added to sauces, anchovies, potted meats, and the preparation of cocoa.

Adulterations are also practised for the purpose of debasing the article, as when the cream is taken from milk by the process of skimming; or when the active principles of spices, etc., have been removed by distillation.

Adulteration of Cattle Foods.—In a recent trial, where the question of adulteration was raised, a linseed-cake maker stated in evidence that the ordinary oil-cake consisted of 50 parts ground sesame cake, 20 parts of bran and 30 of linseed and linseed siftings. To prevent the detection of this fraud by an examination of the cake with the naked eye, it is customary to powder the materials very fine by means of a machine called a "Buffein machine," after which they are thoroughly mixed together and pressed into a cake.

The Adulteration of Seeds, in fraud of her Majesty's subjects, and to the great detriment of agriculture, has been provided for by the Act 32 and 33 Vic. c. 112, wherein it is prohibited to kill, dye or to sulphur seeds, or any way to give them a false appearance, under a penalty of £5 for the first offence, and £50 for the second.

Adulteration of Drugs.—This at all times has been considered a serious offence. In the city of London, the president and censors of the College of Physicians have power to search for apothecaries' wares, drugs, and stuffs, and on finding them defective, corrupted, and not meet nor convenient to be ministered in any medicines for the health of man's body, they are to destroy them, and are to correct and punish the offenders by committing them to prison, and americing them in a penalty not exceeding £20. More recently, in 1872, the Act 35 and 36 Vic. c. 74, renders it penal for any one to adulterate a drug for sale, or to sell such drug. In the first case the penalty is a sum not exceeding £50, together with the costs of the conviction; and for a second offence he shall be guilty of a misdemeanor, and be imprisoned for a period not exceeding six calendar months, with hard labor. In

the second case, the seller of an adulterated drug is subject to a penalty not exceeding £20, together with costs; and for a second offence he shall have his name, place of abode, and offence published in any manner that the justice thinks fit. The chief adulterations and debasing of drugs are the following:—In the case of vegetable substances, as jalap, opium, rhubarb, cinchona bark, &c., foreign substances are added to make up for the loss of weight in drying and powdering, there being in many cases a trade allowance of only four per cent. for such loss, whereas in almost all cases it exceeds this. Roots, seeds, and barks, for example, lose from 6 to 9 per cent., scammony 7 per cent., aloes 9, sarsaparilla 10, squills 12, and opium from 15 to 25 per cent. At other times foreign substances are added to assist in grinding, or to improve the appearance of the article. Occasionally the active principles are removed, or the medicine has become worthless from keeping or from faulty preparation. In the case of the alkaloids, inert substances, as sugar, starch, gum, &c., are mixed with them to increase their weight and bulk. Lastly, the activity of a vegetable drug may greatly depend on its mode and place of culture. With respect to mineral preparations, there is even a still larger field for adulteration, inasmuch that the purity of the article is entirely regulated by the wholesale price of it.

The Adulteration of Textile Fabrics.—Woollen goods have for years past been largely adulterated with refuse fibres called "shoddy" or "mingo." The practice was denounced by Latimer in one of his sermons at Paul's Cross, preached before King Edward in 1635, wherein he spoke of it as the devil's artifice, saying that they were wont to make beds of flock, but now they had turned it into dust, which he aptly called "Devil's dust," and that the cloth worker did so incorporate it in the cloth that it was wonderful to see. The practice is still in vogue, for there is hardly a piece of cheap cloth without it. Shoddy, as originally used was merely the fluff or waste from the looms, but now it consists of any kind of woollen rubbish, as old blankets, stockings, &c., pulled to pieces in a machine called the "Devil." Mingo is even a shorter description of fibre, and is made in the same way from old rags. No less than forty millions of pounds of these are made annually in Yorkshire, at an estimated value of eight millions sterling, and all of it is used for adulterating woollen cloth. There is even another kind of refuse called "extract," which is employed for the same purpose. It consists of the wool obtained from the rags of mixed goods; that is, goods which have a cotton or linen warp blended with wool. The cotton is destroyed by chemical agency, chiefly by means of dilute sulphuric acid, and the wool is left intact.

The cotton fabrics and gray goods of Lancashire and Yorkshire are largely adulterated with size and china clay, the object being to give them increased weight and substance.

Falsification of Coin and Precious Metals.—In Anglo-Saxon times the debasing or counterfeiting of coin was punished by the loss of the hand. In later times it has been criminal in the highest degree. (See MINT and COINAGE.) In the second place, the coin is tested, as to its weight and fineness, by persons skilled in the goldsmith's craft. (See ASSAY.) But, notwithstanding this, the coins of the realm, as issued from the mint, have often been debased to a considerable extent; for, according to Lord Liverpool, the total debasement of the silver money of this country, from the time of the Conquest to the reign of Elizabeth, was not less than 65 per cent. It is notorious that in Spain, Austria and Turkey the degradation of the silver coin, even at the present time, is carried to a serious extent.

The adulteration of precious metals was prohibited

and provided for by the rules and regulations of the various guilds and corporations which took cognizance of the goldsmiths' craft. As early as the 26th of Henry II. (1180) the Goldsmiths' Company of London was founded, and in 1327, when it was incorporated, it was vested with the privilege and power of inspecting, trying and regulating all gold and silver wares throughout the kingdom, and of punishing all offenders who were found guilty of working adulterated gold or silver. The chief offenders appear to have been the cutlers, who were charged with covering base metal in such a manner that it could not easily be detected. It was therefore provided that all manner of vessels of gold and silver should be of "good and true alloy;" and power was given to the company to "go from shop to shop to assay if the gold was good," and finding that it was not of the right touch, it was to be seized and forfeited for the king.

ADULTERY (from the Latin *adulterium*) is the sexual intercourse of a married person with another than the offender's husband or wife. Among the Greeks, and in the earlier period of Roman law, it was not adultery unless a married woman was the offender.

AD VALOREM (Latin, "according to value"), a phrase used in levying customs duties, where the duties are fixed at a percentage on the invoice value of the goods, instead of, or in addition to, a certain rate per pound or number.

ADVENT, the period of the approach of the nativity, lasting, in the Greek Church, from St. Martin's Day (Nov. 11), and, in other churches, from the Sunday nearest to St. Andrew's Day (Nov. 30) till Christmas. The observance of it dates from the fourth century, and it has been recognized from the sixth century as the commencement of the ecclesiastical year.

ADVENTISTS, SECOND, a religious sect, founded by William Miller (1781-1849). See MILLER, WILLIAM, page 4221. They look for a speedy second coming of the Messiah, and have repeatedly fixed dates for that event, basing their predictions upon apocalyptic utterances.

ADVERTISEMENT (from the French *avertissement*, a giving notice, or announcement) denotes in a general sense any information publicly communicated through the press or otherwise. It is the profit derived from advertisements that supports the larger number of newspapers. To advertise advantageously requires both experience and judgment; without a knowledge of the character and circulation of the public journals, much expenditure may be wasted by advertising in papers that have either a limited or inappropriate circulation. The sale of some commodities (such as quack medicines) depends almost wholly on advertising. Advertising often falls disproportionately on books, as it is necessary that new publications should be freely advertised. From this, and their generally ephemeral character, it may be said that ninety-nine out of a hundred pamphlets are published at a loss.

ADVOCATE (from the Latin *advocatus*) a lawyer authorised to plead the causes of litigants in courts of law. The *advocatus* of the Romans meant, as the word implies, a person whose assistance was called in or invoked. The word is not often used among the earlier jurists, and appears not to have had a strict meaning. By the *lex Cincia*, passed about two centuries before Christ, and subsequently renewed, the acceptance of remuneration for professional assistance in lawsuits was prohibited. This law, like all others of the kind, was evaded. The skilful debater was propitiated with a present; and though he could not sue for the value of his services, it was ruled that any *honorarium* so given could not be demanded back, even though he died before the anticipated service was performed. The traces of

this evasion of a law may be found in the existing practice of rewarding counsel by fees in anticipation of services. The term advocate is of frequent use in the chronicles, capitularies, chartularies, and other records of ecclesiastical matters, during the Middle Ages. The term was applied in the primitive church to those who defended the Christians against malignants or persecutors. The advocate, defender, or patron, was of a temporal rank, corresponding to the power of the ecclesiastical body who sought his advocacy. Princes sought the distinction from Rome; and it was as a relic of the practice of propitiating temporal sovereigns by desiring their protection that Henry VIII. received his title of "Defender of the Faith." The office of advocate to any of the great religious houses, possessed of vast wealth, was one of dignity and emolument, generally held by some feudal lord of power and influence. This kind of protection, however, was sometimes oppressive. In the authorities quoted by Du Cange we find that so early as the 12th century, the advocates were accused of rapine and extortion; and by a capitulary of the popedom of Innocent III. they are prohibited from taking and usurping rewards and privileges beyond use and wont. The office at length assumed a fixed character in its powers and emoluments; and it became the practice for the founders of churches and other ecclesiastical endowments to reserve the office of advocate to themselves and their representatives. The term advocate was subsequently superseded by the word patron; but a relic of it still exists in the term *advowson*, and the word *advowee*, which is the form in which the Latin *advocatus* found its way into the technicalities of English law. In France, corporations or faculties of avocats were attached to the parliaments and other tribunals. They formed, before the revolution, a part of the extensive and powerful body commonly called the nobility of the robe. It was not necessary that the avocat should be born noble, and his professional rank was little respected by the hereditary aristocracy; but as a middle rank, possessed of great powers and privileges, which it jealously guarded, the profession acquired great influence. The Faculty of Advocates is the collective term by which the members of the bar are known in Scotland. They professionally attend the supreme courts in Edinburgh; but they are privileged to plead in any cause before the inferior courts, where counsel are not excluded by statute. This body has existed by immemorial custom. Its privileges are constitutional, and are founded on no statute or charter of incorporation. The body formed itself gradually, from time to time, on the model of the French corporations of avocats, appointing like them a dean or doyen, who is their principal officer. No curriculum of study, residence, or professional training was, until 1856, required on entering this profession; but the faculty have always had the power, believed to be liable to control by the Court of Session, of rejecting any candidate for admission. The candidate undergoes two private examinations—the one in general scholarship, in lieu of which, however, he may produce evidence of his having graduated as master of arts in a Scottish university, or obtained an equivalent degree in an English or foreign university; and the other, at the interval of a year, in Roman, private, international, and Scots law. He must, before the latter examination, produce evidence of attendance at classes of Scots law and conveyancing in a Scottish university, and at classes of civil law, public or international law, constitutional law, and medical jurisprudence in a Scottish or other approved university.

LORD ADVOCATE, or **KING'S ADVOCATE**, is the principal law-officer of the crown in Scotland. His business is to act as a public prosecutor, and to plead in

all causes that concern the crown. He has the privilege of pleading in court with his hat on.

ADVOCATION, in *Scottish Law*, was a mode of appeal from certain inferior courts to the supreme court.

ADVOCATUS DIABOLI (the "Devils advocate"), the name given to the person appointed to state the objections to a proposed canonization in the Roman Catholic Church. On the other side the *Advocatus Dei* undertakes the defense of the proposed new saint.

ADVOWSON, or **ADVOWZEN** (*advocatio*) in *English Common Law*, the right of presentation to a vacant ecclesiastical benefice, is so called because the patron defends or advocates the claims of the person whom he presents. Originally all appointments within a diocese lay with the bishop; but when a landowner founded a church on his estate and endowed it, his right to nominate the incumbent was usually recognised. Where the right of presentation remains attached to the manor, it is called an advowson *appendant*, and passes with the estate by inheritance or sale without any special conveyance. A sale is absolutely prohibited during the mortal sickness of the incumbent, or during the existence of a vacancy. There are upwards of 13,000 benefices in the Church of England.

ADYTUM, the most retired and sacred place of ancient temples, into which none but the officiating priests were allowed to enter. The Most Holy Place of the temple of Solomon was of the nature of the pagan adytum; none but the high priest being admitted into it, and he but once a year.

Æ, or **AE**, a diphthong, compounded of A and E, of frequent occurrence in Latin and in Anglo-Saxon. In the best editions of the classics the form now preferred is *æ*.

ÆACUS, in *Mythology*, the son of Jupiter by Ægina. When the isle of Ægina was depopulated by a plague, his father, in compassion to his grief, changed all the ants upon it into men and women, who were called *Myrmidones*.

ÆDILE, in *Roman Antiquity*, a magistrate whose chief business was to superintend buildings of all kinds, but more especially public ones, as temples, aqueducts, bridges, &c. To the ædiles likewise belonged the care of highways, public places, weights and measures, &c. They also superintended the markets, fixed the prices of provisions, took cognisance of breaches of decency and public order, and took charge of police matters generally. The custody of the *plebiscita*, or decrees of the people, and *senatus consulta*, or decrees of the senate, was likewise committed to them. They had the inspection of theatres and plays, and were obliged to exhibit magnificent games to the people, usually at their own expense, whereby many of them were ruined.

ÆGADES, or **ÆGATES**, a group of islands off the western coast of Sicily, between Trapani and Marsala, consisting of Maretime, Levanzo, and Favignana.

ÆGEAN SEA, a part of the Mediterranean, now more usually called the Archipelago or Grecian Archipelago. See **ARCHIPELAGO**.

ÆGEUS, in *Fabulous History*, the son of Pandion, was king of Athens, and the father of Theseus. He was one of the Athenian heroes, but is notable chiefly for the manner of his death. The Athenians having killed Androgeus, the son of Minos, king of Crete, for carrying away the prize for wrestling from them, Minos made war upon them; and being victorious, imposed this severe condition to Ægeus, that he should annually send into Crete seven of the noblest of the Athenian youths and as many maidens, chosen by lot, to be devoured by the Minotaur. On the fourth year of this tribute the choice fell on Theseus, or, as others say, he

himself entreated to be sent. The king, at his son's departure, gave orders that, as the ship sailed with black sails, it should return with the same in case he perished; but if he came back victorious he should change them for white. When Theseus returned from Crete after killing the Minotaur, he forgot to change the sails in token of his victory, according to the agreement; and his father, who sat on a rock watching the return of the vessel, imagining from the black sail that his son was dead, cast himself headlong into the sea, which was supposed in consequence to have obtained the name of the *Ægean Sea*.

ÆGINA, in *Fabulous History*, the daughter of Asopus, king of Boeotia, was beloved by Jupiter, who carried her from Epidaurus to a desert island called *Enopia*, which was afterwards called by her name. See **ÆACUS**.

ÆGINA, or **EGINA**, or **ENGIA**, an island in the Saronic gulf, 20 miles distant from the Piræus, formerly vying with Athens in naval power, and, at the sea-fight of Salamis, disputing the palm of victory with the Athenians. The victory of Salamis was in a great measure owing to the thirty ships of Ægina, and the voice of grateful Greece assigned to her warriors on that eventful day the prize of valor. Yet, not long after, the rivalry of Athens began to cloud the prosperity of the haughty islanders, whose fleet she had before defeated, and Ægina at length sunk under the enmity of a relentless commercial rival, that banished her citizens and supplied their place with Attic colonists. After the close of the Peloponnesian war, Lysander restored the banished inhabitants, but Ægina never recovered its ancient prosperity.

ÆGINETA, **PAULUS**, a celebrated surgeon of the island of Ægina, whence he derived his name. According to Le Clerc's calculation, he lived in the 4th century. His knowledge in surgery was very great, and his works are deservedly famous. Ægineta is the first writer who takes notice of the cathartic property of rhubarb, and, according to Dr. Milward, is the first in all antiquity who deserves the title of accoucheur.

ÆGIS, in *Classical Mythology, a name given to the shield or buckler of Jupiter. The goat Amalthæa, which had suckled that god, being dead, he is said to have covered his buckler with the skin, or used the skin as a buckler. When so used it would usually be fastened on the right shoulder, and would partially envelope the chest as it passed obliquely round in front and behind to be attached to the shield under the left arm.*

ÆGISTHUS, in *Ancient History*, was the son of Thyestes by his own daughter Pelopea, who, to conceal her shame, exposed him in the woods. Some say he was taken up by a shepherd and suckled by a goat; whence he was called *Ægisthus*. After he grew up he was recognized by his father, and on the death of the latter he became king of Mycenæ.

ÆGOSPOTAMI, in *Ancient Geography*, a small river in the Thracian Chersonesus, running south-east, and falling into the Hellespont to the north of Sestos, — with a town of the same name, and a station or road for ships, at its mouth.

ÆLFRIC, "the Grammarian," as he has been called, is one of the most voluminous of our old English writers before the Conquest. He flourished at the latter end of the 10th century and the beginning of the 11th. Ælfric afterward removed to Cerne Abbey, in Dorsetshire, where he composed his *Homilies*, the work on which his fame as an author chiefly depends. They are 80 in number. In composing them, Ælfric drew largely from the fathers. Their style is very simple and pleasing, and obscure words are carefully avoided in order to

adapt them to the capacity even of the most ignorant.

ÆLIA CAPITOLINA, a name given to the city built by the Emperor Hadrian, A.D. 134, near the spot where the ancient Jerusalem stood, which he found in ruins when he visited the eastern parts of the Roman empire.

ÆLIANUS, CLAUDIUS, born at Præneste, in Italy. He taught rhetoric at Rome, under the Emperor Alexander Severus, according to Perizonius, but more probably under Hadrian. He was surnamed "Honey-tongued," on account of the ease and accuracy with which he spoke and wrote. His curious and entertaining work entitled *Varia Historia* has been frequently republished, as well as his treatise *De Natura Animalium*.

ÆMILIUS, PAULUS, the name of a celebrated family of the Æmilia Gens. See **PAULUS**.

ÆMILIUS, PAULUS, or **PAOLO EMILIO**, a celebrated historian, born at Verona, who obtained such reputation in Italy that he was invited into France by the cardinal of Bourbon, in the reign of Charles VIII., in order to write the history of the kings of France in Latin, and was presented to a canonry in Notre Dame. He died at Paris on the 5th of May 1529.

ÆNEAS, in *Fabulous History*, a Trojan prince, the son of Venus and Anchises. He plays a conspicuous part in the *Iliad*, and is represented, along with Hector, as the chief bulwark of the Trojans. Homer always speaks of Æneas and his descendants as destined to reign at Troy after the destruction of Priam and his house. Virgil has chosen him as the hero of his great epic and the story of the *Æneid*.

ÆNEAS SYLVIVS, POPE. See **PIUS II**.

ÆOLÆ INSULÆ, the modern **LIPARI ISLANDS**, a group of islands between Italy and Sicily. They are so called from Æolus, the god of the winds, who was supposed to rule over them.

ÆOLIAN HARP, named from Æolus, god of the wind, a musical instrument consisting of cat-gut strings stretched over a wooden sound-box. When exposed to a current of air, the strings produce a variety of pleasing harmonic sounds in strange succession and combination.

ÆOLIS, or **ÆOLIA**, in *Ancient Geography*, a country of Asia Minor, settled by colonies of Æolian Greeks. The name in its limited sense was applied to the coast extending from the river Hermus to the promontory of Lectum.

ÆOLUS, in *Heathen Mythology, the god and father of the winds, was variously represented as the son of Hippotes, or of Neptune by a daughter of Hippotes, or of Jupiter. In the *Odyssey* he is mentioned as the king of the Æolian isle to whom Jupiter had given the superintendence and distribution of the winds.*

ÆON, a space of time, was often used in Greek to denote indefinite or infinite duration; and hence, by metonymy, for a being that exists for ever. See **GNOSTICISM**.

ÆPINUS, FRANZ MARIA ULRICH THEODOR, a distinguished German natural philosopher, was born at Rostock in Saxony in 1724, and died at Dorpat in August 1802. After studying medicine for a time, Francis Æpinus devoted himself to the physical and mathematical sciences, in which he soon gained such distinction that he was admitted a member of the Berlin Academy of Sciences. He enjoyed the special favor of the Empress Catharine II., who appointed him tutor to her son Paul. Æpinus is best known by his researches, theoretical and experimental, in electricity and magnetism. Adopting Franklin's theory of positive and negative electricities, or electric forces, he investigated the relations of these fully, and especially the conditions of their equilibrium;

and many of the conclusions he arrived at do not depend for their value and importance on the theory of Franklin. It is to be added that Æpinus was the first to perceive and define, with any measure of clearness, the affinity between electricity and magnetism. His discussion of the effects of parallax in the transit of a planet over the sun's disc excited great interest, having appeared (in 1764) between the dates of the two transits of Venus that took place during last century.

ÆQUI, an ancient and warlike people of Italy, inhabiting the upper valley of the Anio.

ÆRARIANS, a class in ancient Rome, composed of citizens who had suffered the severest kind of degradation the censors could inflict. Though heavily taxed, they could not vote in assemblies or serve in the army, and were deprived of and excluded from all posts of honor and profit. Romans of the higher classes, as well as the plebeians, were liable to become Ærarians.

ÆRARIUM, the public treasury at ancient Rome. It contained the moneys and accounts of the state, and also the standards of the legions, the public laws engraven on brass, the decrees of the senate, and other papers and registers of importance. In addition to the common treasury, supported by the general taxes and charged with the ordinary expenditure, there was a reserve treasury, also in the temple of Saturn, maintained chiefly by a tax of 5 per cent on the value of all manumitted slaves which was not to be had recourse to, or even entered, except in extreme necessity.

AERATED BREAD, is bread not fermented with yeast, or leavened, but mechanically charged with carbonic acid gas, usually derived from carbonic acid water.

AERATED WATERS. Waters impregnated with an unusually large portion of carbonic acid, or other gaseous substances, occur abundantly in springs throughout the world; and, in addition to their gaseous constituents, generally hold in solution a large percentage of different salts. The manufacture of aerated waters arose out of the attempt to imitate these by artificial means. The earliest method of producing acidulated water was that which still obtains in the preparation of effervescing draughts, such as are made from "Seidlitz" powders. These powders consist of separate portions of sodium bicarbonate and tartaric acid, which, on being dissolved together in water, form sodium tartrate and liberate carbonic acid, which bubbles up through the water.

Real soda-water is best prepared by adding to the water before aeration a proportion of sodium bicarbonate equal to about 30 or 36 grains per pint of water. Potash-water, Seltzer, lithia, Carrara, bromide of potassium, and a host of other waters, are similarly prepared, the various salts being used in different proportions, according to the taste and experience of manufacturers. Lemonade, and other aerated drinks flavored with fruit syrups, have the proportion of syrup placed in the bottle to which simple aerated water taken from a receiver, indicating a pressure of 80 to 100 lb. per square inch, is added. The "soda water" of the modern soda fountain is made by saturating water with carbonic acid gas, generated in a receiver, at high pressure, by pouring dilute sulphuric acid over marble dust, and introduced into a strong copper tank, whence it is forced by pressure of the gas. On account of the rapidity with which the gas escapes on the removal of pressure, special arrangements are required for the bottling and corking processes, and the frequent explosion of bottles necessitates guards to protect the bottler. A dexterous bottler will fill and cork 5000 bottles in ten hours. The consumption of aerated waters, especially in hot climates, is very great.

AERØE, or **ARØE** an island of Denmark, in the Little Belt, lying $7\frac{1}{2}$ miles S. of Funen, between Alsen and Langeland. Population 16,500.

AERONAUTS.

Standing in the front rank of those who have made rapid and important strides toward the solution of the problem of aerial navigation, we find M. Alberto Santos-Dumont, the son of a Brazilian coffee planter, born in 1873. Early in his youth he became interested in balloons, flying-machines, and everything pertaining to navigation in the air. His first experiments were with spherical machines, but he soon abandoned those for the cylindrical form, and attained his first real achievement with one of the latter shape in November, 1899, when he entered his ship within the walls of Paris for the purpose of encircling the Eiffel Tower. Rising to a height of some 500 feet, he took a westerly course and circled that great structure within 300 feet of it, coming down safely at the Moulin in the Bois de Boulogne. The ship in which this famous trip was made was a cigar-shaped wicker car with screw propeller, 111 feet long by 20 feet in diameter. No other experiment of his has been quite so successful, but it is now believed that the problem has passed the guesswork stage and needs but a little further development, along the lines followed by Dumont, to establish this great invention's commercial value.

During the darkness of the Middle Ages every one at all distinguished for his knowledge in physics was generally reputed to have obtained the power of flying in the air. Friar Bacon did not scruple to claim the invention; and the credulity and indulgent admiration of some authors have lent to these pretensions more credit than they really deserved. Albertus Magnus, who flourished in the first half of the 13th century, was reputed to have discovered the art; and to give an idea of the state of the physical sciences at that time, it is worth while to quote the following recipes:—"Take one pound of sulphur, two pounds of willow-carbon, six pounds of rock-salt ground very fine in a marble mortar; place, when you please, in a covering made of flying papyrus to produce thunder. The covering, in order to ascend and float away, should be long, graceful, well filled with this fine powder; but to produce thunder, the covering should be short, thick, and half full." Regiomontanus, the first real mathematician after the partial revival of learning, is said, like Archytas, to have formed an artificial dove, which flew before the Emperor Charles V. at his public entry into Nuremberg; but the date of Regiomontanus's death shows this to have been impossible.

Attempts at flying have, as a rule, been made by a somewhat low class of projectors, who have generally united some little share of ingenuity to a smattering of mechanics. At the beginning of the 16th century an Italian alchemist visited Scotland, and was collated by James IV. to the abbacy of Tungland, in Galloway. Having constructed a set of wings, composed of various plumage, he undertook from the walls of Stirling Castle to fly through the air to France. This feat he actually attempted, but he soon came to the ground, and broke his thigh-bone by the violence of the fall—an accident he explained by asserting that the feathers of some fowls were employed in his wings, and that these had an affinity for the dunghill, whereas, if composed solely of eagles' feathers, they would have been attracted to the air. In 1617, Fleyder, rector of the grammar school at Tübingen, delivered a lecture on flying, which he published eleven years afterwards. A poor monk, however, ambitious to reduce the theory to practice, provided himself with wings; but his machinery broke down, and, falling to the ground, he broke his legs and perished. Bishop Wilkins says it was related that "a certain English monk called Elmerus, about the Confessor's time," flew by means of wings from a tower a dis-

tance of more than a furlong; that another person flew from St. Mark's steeple at Venice; and another, at Nuremberg. He also quotes Busbequius to the effect that a Turk also attempted something of the kind at Constantinople.

In Borelli's posthumous work, published at Rome in 1680-81, he calculated the enormous strength of the pectoral muscles in birds; and his proposition is entitled "Est impossibile, ut homines propriis viribus artificiosè volare possint," in which he clearly points out the impossibility of man being able by muscular strength to give motion to wings of sufficient extent to keep him suspended in the air.

A very slight consideration of the matter shows that, although the muscles of man may not be of sufficient strength to enable him to use wings, this objection does not apply against the possibility of making a flying chariot in which the motive power should be produced mechanically, as in a watch, or a boat to float in the atmosphere.

Albert of Saxony, a monk of the order of St. Augustine, and a commentator on the physical works of Aristotle, seems first to have comprehended (though in a very vague and erroneous manner) the principles on which a body might be made to float in the atmosphere. Adopting, of course, Aristotelian views with regard to the nature of the elements, he considered that, as fire is more attenuated, and floats above our atmosphere, therefore a small portion of this ethereal substance, enclosed in a light, hollow globe, would raise it to a certain height and keep it suspended in the air; and that, if more air were introduced, the globe would sink like a ship when water enters by a leak. Long afterwards Francis Mendoza, a Portuguese Jesuit, who died in 1626, at the age of forty-six, embraced this theory, and he held that the combustible nature of fire was no real obstacle, as its extreme levity and the extension of the air would prevent it from supporting inflammation. Casper Scott, also a Jesuit, adopted the same speculation, only that he replaced the fire by the thin ethereal substance which he believed floated above our atmosphere.

The discovery of the balloon was due to Stephen and Joseph Montgolfier, sons of Peter Montgolfier, a large and celebrated papermaker at Annonay, a town about 40 miles from Lyons. The brothers had observed the suspension of clouds in the atmosphere, and it occurred to them that if they could enclose any vapor of the nature of a cloud in a large and very light bag, it might rise and carry the bag with it into the air. They accordingly made experiments, inflating bags with smoke from a fire placed underneath, and found either that the smoke or some vapor emitted from the fire did ascend and carry the bag with it. Being thus assured of the correctness of their views, they determined to have a public ascent of a balloon on a large scale. They accordingly invited the States of Vivarais, then assembled at Annonay, to witness their aerostatic experiment; and on June 5, 1783, in the presence of a considerable concourse of spectators, a linen globe of 105 feet in circumference was inflated over a fire fed with small bundles of chopped straw, and when released rapidly rose to great height, and descended, at the expiration of ten minutes, at the distance of about 1½ mile. This was the discovery of the balloon. In Montgolfier's first balloon, no source of heat was taken up with it, so that the air inside rapidly cooled, and the balloon soon descended.

The news of the experiment at Annonay rapidly spread over Europe, and at Paris attracted so much attention that M. Faujas de Saint-Fond, a naturalist, set on foot a subscription for paying the expense of repeating the experiment. The balloon was constructed by two brothers of the name of Robert, under the

superintendence of M. Charles, professor of natural philosophy in Paris, and afterward a member of the Academy of Sciences. It had at first been suggested to copy the process of Montgolfier, but Charles proposed the application of hydrogen gas, which was adopted. The filling of the balloon, which was made of thin silk varnished with a solution of elastic gum, and was about 13 feet in diameter, was commenced on August 23, 1783, in the Place des Victoires. The hydrogen gas was obtained by the action of dilute sulphuric acid upon iron filings, and was introduced through leaden pipes; but as the gas was not passed through cold water, great difficulty was experienced in filling the balloon completely; and altogether about 500 lb. of sulphuric acid, and twice that amount of iron filings were used. Bulletins were issued daily of the progress of the inflation; and the crowd was so great that on the 26th the balloon was moved to the Champ de Mars, a distance of 2 miles. This was done secretly, in the middle of the night, to avoid the crowd; and the appearance of the balloon being thus removed, preceded by lighted torches, and escorted by a detachment of soldiers, is described as having been very remarkable. On the next day, August 27, an immense concourse of people covered the Champ de Mars, and every spot from which a view could be obtained was crowded. About five o'clock a cannon was discharged as the signal for the ascent, and the balloon, when liberated, rose to the height of about 3000 feet with great rapidity. A shower of rain which began to fall directly after the balloon had left the earth in no way checked its progress; and the excitement was so great, that thousands of well-dressed spectators, many of them ladies, stood exposed, watching it intently the whole time it was in sight, and were drenched to the skin. The balloon, after remaining in the air for about three-quarters of an hour, fell in a field near Gonesse, about 15 miles off, and terrified the peasantry so much that it was torn into shreds by them. Hydrogen gas was at this time known by the name of inflammable air; and balloons inflated with gas have ever since been called by the people air-balloons, the kind invented by the Montgolfiers being designated fire-balloons.

The first human being who ascended in a balloon was M. François Pilâtre de Rozier, a young naturalist, who, two years afterwards, was killed in an attempt to cross the English Channel in a balloon. On October 15, 1783, and following days, he made several ascents (generally alone, but once with a companion, M. Girond de Vilette), in a captive balloon (*i.e.*, one attached by ropes to the ground), and demonstrated that there was no difficulty in taking up fuel and feeding the fire, which was kindled in a brazier suspended under the balloon, when in the air. The way being thus prepared for aerial navigation, on November 21, 1783, M. Pilâtre de Rozier and the Marquis d'Arlandes first trusted themselves to a free fire-balloon. The experiment was made from the Jardin du Chateau de la Muette, in the Bois de Boulogne. The machine employed, which was a large fire-balloon, was inflated at about two o'clock, and leaving the earth at this time, it rose to a height of about 500 feet, and passing over the Invalides and the Ecole Militaire, descended beyond the Boulevards, about 9000 yards from the place of ascent, having been between twenty and twenty-five minutes in the air. The result was completely successful; and it is scarcely necessary to add, the excitement in Paris was very great.

Only ten days later, viz., on December 1, 1783, MM. Charles and Robert ascended from Paris in a balloon inflated with hydrogen gas. The balloon, as in the case of the small one of the same kind previously launched from the Champ de Mars, was constructed by

the brothers Robert. It was 27 feet in diameter, and the car was suspended from a hoop surrounding the middle of the balloon, and fastened to a net which covered the upper hemisphere. The balloon ascended very gently from the Tuileries at a quarter to two o'clock, and after remaining for some time at an elevation of about 2000 feet, it descended in about two hours at Nesle, a small town about 27 miles from Paris, when M. Robert left the car, and M. Charles made a second ascent by himself. He had intended to have replaced the weight of his companion by a nearly equivalent quantity of ballast; but not having any suitable means of obtaining such ready at the place of descent, and it being just upon sunset, he gave the word to let go, and the balloon being thus so greatly lightened, ascended very rapidly to a height of about 2 miles. After staying in the air about half-an-hour, he descended 3 miles from the place of ascent, although he believed the distance traversed, owing to different currents, to have been about 9 miles. In this second journey M. Charles experienced a violent pain in his right ear and jaw, no doubt produced by the rapidity of the ascent. He also witnessed the phenomenon of a double sunset on the same day; for, when he ascended, the sun had set in the valleys, and as he mounted he saw it rise again, and set a second time as he descended.

All the features of the modern balloon as now used are more or less due to Charles, who invented the valve at the top, suspended the car from a hoop, which was itself attached to the balloon by netting, &c. The M. Robert who accompanied him in the ascent was one of the brothers who had constructed it.

On January 19, 1784, the largest balloon on record (if the contemporary accounts are correct) ascended from Lyons. It was more than 100 feet in diameter, about 130 feet in height, and when distended had a capacity, it is said, of over half-a-million cubic feet. It was called the *Flesselles*, and after having been inflated from a straw fire in seventeen minutes, it rose with seven persons in the car, viz., Joseph Montgolfier, Pilâtre de Rozier, Count de Laurencin, Count de Dampierre, Prince Charles de Ligne, Count de Laport d'Anglefort, and M. Fontaine, the last gentleman having leaped into the car just as the machine had started. The fire was fed with trusses of straw, and the balloon rose majestically to the height of about 3000 feet, but descended again after the lapse of about a quarter of an hour from the time of starting, in consequence of a rent in the upper part.

It is proper here to state that researches on the use of gas for inflating balloons seem to have been carried on at Philadelphia nearly simultaneously with the experiments of the Montgolfiers; and when the news of the latter reached America, Messrs. Rittenhouse and Hopkins, members of the Philosophical Academy of Philadelphia, constructed a machine consisting of forty-seven small hydrogen gas-balloons attached to a car or cage. After several preliminary experiments, in which animals were let up to a certain height by a rope, a carpenter, one James Wilcox, was induced to enter the car for a small sum of money; the ropes were cut, and he remained in the air about ten minutes, and only then effected his descent by making incisions in a number of the balloons, through fear of falling into the river, which he was approaching.

The improvements that have been made in the management and inflation of balloons in the last ninety years have only had reference to details, so that as far as essential principles are concerned the subject is now in pretty much the same state as it was in 1783. We have therefore arrived at a point in the history of the balloon where it is well to consider how much the Montgol-

fiers and Charles owed to their predecessors; and it is proper here to state that, although we have assigned the invention to the two brothers, Stephen and Joseph—as no doubt they both conducted the early experiments together—still there is reason to believe that the share of the latter was very small. Stephen, however, although the originator of balloons, does not appear ever to have ascended himself, and Joseph did not repeat the ascent just mentioned in the *Flesselles*. The Montgolfiers had studied Priestley's *Experiments relating to different kinds of Air*, whence they first conceived the possibility of navigating the atmosphere; but their experiment was so simple as to require scarcely any philosophical knowledge. They had seen smoke ascend, and thought that if they could imprison it in a bag, the bag might ascend too; and the observation and reasoning were both such as might occur to anybody. This does not detract from their merit; it, on the contrary, adds to it.

We now return to the history of aerial navigation, and commence with an account of the first ascents of balloons in Great Britain. Although the news of the Annonay and subsequent experiments in France rapidly spread all over Europe, and formed a topic of general discussion, still it was not till five months after the Montgolfiers had first publicly sent a balloon into the air that any aerostatic experiment was made in England. In November 1783 Count Zambecari, an Italian, who happened to be in London, made a balloon of oil-silk, 10 feet in diameter, and weighing 11 lb. It was publicly shown for several days, and on the 25th it was three-quarters filled with hydrogen gas, and launched from the Artillery ground at one o'clock. It descended after two hours and a half near Petworth, in Sussex, 48 miles from London. This was the first balloon that ascended from English ground. On February 22, 1784, a hydrogen gas balloon, 5 feet in diameter, was let up from Sandwich, in Kent, and descended at Warneton, in French Flanders, 75 miles distance. This was the first balloon that crossed the Channel. The difficulties and dangers of aerial navigation having been surmounted by the end of the year 1783, the ascents of balloons were now multiplied in all quarters. It will therefore be sufficient to notice very briefly only the more remarkable of the succeeding ascents.

The Chevalier Paul Andreani, of Milan, constructed a fire balloon 68 feet in diameter, and on February 25, 1784, ascended from Milan with two brothers of the name of Gerli, and remained in the air for about twenty minutes. This is usually regarded as the first ascent in Italy (but see Monck Mason's *Aeronautica*, p. 247). Andreani ascended again on March 13, with two other persons.

On the 2d of March M. Jean Pierre Blanchard, who had been for some years before occupied with projects for flying, made his first voyage from Paris in a balloon 27 feet in diameter, and descended at Billancourt, near Sévres. Just as the balloon was about to ascend, a young man jumped into the car, and, drawing his sword, declared his determination to ascend with Blanchard. He was ultimately removed by force.

On July 15, 1784, the Duc de Chartres and the two brothers Robert ascended from St. Cloud; but the neck of the balloon becoming choked up with an interior balloon filled with common air, intended to regulate the ascending and descending power, they were obliged to make a hole in the balloon, in order to allow the escape of the gas, but they descended in safety.

The first person who rose into the air from British ground appears to have been Mr. J. Tytler, who ascended from the Comedy Gardens, Edinburgh, on August 27, 1784, in a fire-balloon of his own construc-

tion. He descended on the road to Restalrig, about half-a-mile from the place where he rose.

Although by a few days Tytler has the precedence, still his attempts and partial success were all but totally unknown; whereas Lunardi's experiments excited an enormous amount of enthusiasm in London, and it was he that practically introduced aerostation into that country in the face of very great disadvantages. We have already referred to the extraordinary apathy displayed in England with regard to aerostatic experiments, one cause of which was that their introduction was due to a foreigner. Vincent Lunardi was secretary to Prince Caramanico, the Neapolitan ambassador, and his published letters to his guardian, the Chevalier Compagni, written while he was carrying out his project, and detailing all the difficulties, &c., he met with as they occurred, are very interesting, and give a vivid account of the whole matter. His balloon was 33 feet in circumference, and was exposed to the public view at the Lyceum, in the Strand, where it was visited by upwards of 20,000 people. It was his original intention to have ascended from Chelsea Hospital, but the conduct of a crowd at a garden at Chelsea, which destroyed the fire-balloon of a Frenchman named De Moret, who announced an ascent on August 11, but was unable to keep his word, led to the withdrawal of the leave that had been granted. Ultimately, after some difficulties had been arranged, he was permitted to ascend from the Artillery ground, and, on September 15, 1784, the inflation with hydrogen gas took place. Lunardi ascended alone, in presence of the Prince of Wales and an enormous crowd of spectators. He took up with him a pigeon, a dog, and a cat, and the balloon was provided with oars, by means of which he hoped to raise or lower it at pleasure. Shortly after starting, the pigeon escaped, and one of the oars became broken and fell to the ground. In about an hour and a half he descended at South Mimms, in Hertfordshire, and landed the cat, which had suffered from the cold; he then ascended again, and then descended, after the lapse of about three-quarters of an hour, at Standon, near Ware, where he had great difficulty in inducing the peasants to come to his assistance; but at length a young woman, taking hold of one of the cords, urged the men to follow her example, which they then did. The excitement caused by this ascent was immense, and Lunardi at once became the star of the hour. He was presented to the king, and was courted and flattered on all sides. The king was in conference with his ministers; but on hearing that the balloon was passing, he broke up the discussion, remarking that they might resume their deliberations, but that perhaps they might not see Lunardi again; upon which, he, Mr. Pitt, and the other ministers viewed the balloon through telescopes. The balloon was afterwards exhibited in the Pantheon. In the latter part of the following year (1785) Lunardi made several very successful ascents from Kelso, Edinburgh, and Glasgow (in one of which he traversed a distance of 110 miles); these he has described in a second series of letters. He subsequently returned to Italy, where we believe he still followed the practice of aerostation, and made many ascents. He died on July 31, 1806, at Lisbon, according to the *Gentleman's Magazine*, but a contemporary newspaper gives Genoa as the place, and adds that he died in a state of very great indigence.

Lunardi's example was soon followed by others, and, on October 16, 1784, Blanchard ascended from Little Chelsea with Mr. Sheldon, and having deposited the latter at Sunbury, rose again alone, and descended at Romney Marshes. On November 12, Mr. James Sadler, sen., ascended from Oxford, and there is every reason to believe that he made a previous ascent from the same

place on October 12, four days previous to Blanchard's (see Monck Mason, p. 274, where it is stated that he attempted to ascend in a fire-balloon on September 12, but that the balloon was burnt). On November 30, 1784, Blanchard again ascended, accompanied this time by Dr. J. Jeffries, an American physician. On January 4, 1785, Mr. Harper ascended from Birmingham; and on January 7, Blanchard and Dr. Jeffries achieved the feat of crossing the Channel from Dover to Calais. At seven minutes past one the balloon left Dover Castle, and in their passage they had a most magnificent view of both shores. When about one-third across they found themselves descending, and threw out every available thing from the boat or car. When about three-quarters across they were descending again, and had to throw out not only the anchor and cords, but also to strip and throw away part of their clothing, after which they found they were rising, and their last resource, viz., to cut away the car, was rendered unnecessary. As they approached the shore the balloon rose, describing a magnificent arch high over the land. They descended in the forest of Guinnes.

On March 23, 1785, Count Zambeccari, who had, as we have seen, launched the first balloon from English ground, ascended for the first time with Admiral Vernon from London. Shortly afterwards he returned to his own country, and there applied himself assiduously to the practice of aerial navigation. He twice, in 1803 and 1804, descended into the Adriatic, and both times only escaped after undergoing much danger. Descending in a fire-balloon on September 21, 1812, after a voyage from Bologna, the shock of the grapnel catching in a tree caused the balloon to catch fire; and to save themselves from being burnt, Zambeccari and his companion, Signor Bonaga, leaped from the car. The former was killed on the spot, but the latter, though fearfully injured, escaped with his life.

On June 15, 1785, Pilâtre de Rozier made his last fatal voyage from Boulogne. It was his intention to have repeated the exploit of Blanchard and Jeffries in the reverse direction, and have crossed from Boulogne to England. For this purpose he had contrived a double balloon, which he expected would combine the advantages of both kinds—a fire-balloon, 10 feet in diameter, being placed underneath a gas-balloon of 37 feet in diameter, so that by decreasing or diminishing the fire in the former it might be possible to ascend or descend without waste of gas. Rozier was accompanied by M. P. A. Romain, and for rather less than half an hour after the aerostat ascended all seemed to be going on well, when suddenly the whole apparatus was seen in flames, and the unfortunate adventurers came to the ground from the supposed height of more than 3000 feet. Rozier was killed on the spot, and Romain only survived about ten minutes. A monument was erected on the place where they fell, which was near the sea-shore, about four miles from the starting-point. The Marquis de la Maisonfort had accompanied Rozier to Boulogne, intending to ascend with him, but M. Romain there insisted on a prior promise. Either the upper balloon must have been reached by the flames, and the gas taken fire, or the gas must have poured down into the lower balloon, and so have caused the explosion.

We must not forget to mention that on June 4, 1784, Madame Thible ascended from Lyons in a fire-balloon with M. Fleurand, in the presence of King Gustavus of Sweden, then travelling under the name of Count Haga. Madame Thible is very likely the only woman who ever ascended in a fire-balloon. The first Englishwoman who ever ascended into the air was Mrs. Sage, who accompanied Mr. Biggin in his voyage from London on June 29, 1785.

Accounts are given of an ascent at Constantinople,

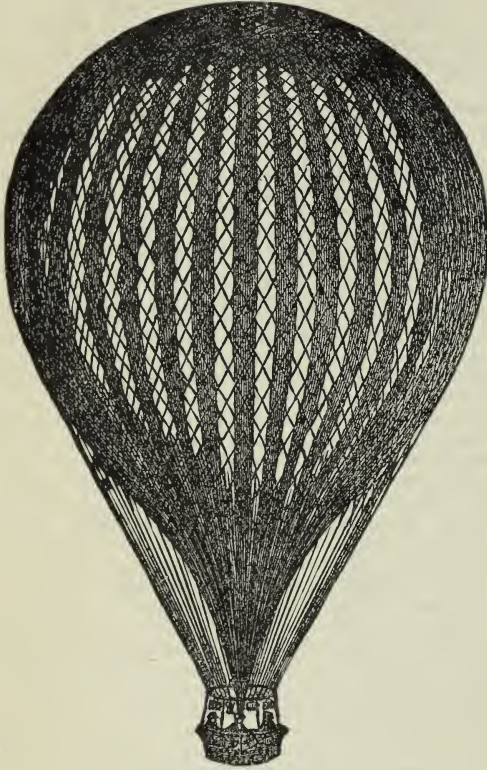
made in the presence of the Sultan, by a Persian physician, accompanied by two Bostangis, early in the year 1786, who, crossing the sea which divides Europe from Asia, descended about 30 leagues from the coast.

The substitution of coal-gas for hydrogen is due to Mr. Charles Green, the veteran aeronaut, who made several hundred ascents, the first of which took place on July 19, 1821, the coronation day of George IV. In this ascent ordinary coal-gas was first used; and every balloon, with very few exceptions, that has ascended since this date, has been so inflated. Pall Mall was first lighted by gas in 1807, and at the end of 1814 the general lighting of London by gas commenced; so that coal-gas could not have been available for filling balloons long before it was actually used.

Leaving out of consideration the ascents undertaken for scientific objects (very many of which were remarkable for the height attained or the distance traversed, and which will be specially noticed further on), we proceed to mention the most noteworthy ascents that have taken place and that have not ended fatally (these latter will be referred to separately). Mr. Crosbie, a gentleman who was the first to ascend from Ireland (January 19, 1785), on the 19th of July, 1785, attempted to cross St. George's Channel to England, but fell into the sea; he was saved by some vessels that came to his rescue. Lunardi also fell into the sea, about a mile and a half from the shore, after an ascent from Edinburgh in December 1785; he was rescued by a fishing-boat. Richard Maguire was the second person who ascended from Ireland. Mr. Crosbie had inflated his balloon on May 12, 1785, but it was unable to take him up, when Mr. Maguire, a student at the university, who was present, offered to ascend. His offer was accepted, and he made the ascent. For this he was knighted by the Lord-Lieutenant (Monck Mason, p. 266). On July 22, 1785, Major Money ascended from Norwich. The balloon was blown out to sea, and he was obliged to descend into the water. After remaining there seven hours he was rescued by a revenue cutter which had been despatched to his assistance. Mr. James Sadler attempted to cross St. George's Channel on the 1st of October, 1812, and had nearly succeeded, when, in consequence of a change in the wind, he was forced to descend into the sea off Liverpool. After remaining in the water some time, he was rescued by a fishing-boat. But on July 22, 1817, Mr. Windham Sadler, his second son, succeeded in crossing the Channel from Dublin to Holyhead. On May 24, 1837, Mr. Sneath ascended from near Mansfield in a fire-balloon, and descended safely. At half-past one o'clock on November 7, 1836, Mr. Robert Holland, Mr. Monck Mason and Mr. Charles Green ascended from Vauxhall Gardens, and descended at about two leagues from Weilburg, in the duchy of Nassau, at half-past seven the next morning, having thus traversed a distance of about 500 miles in 18 hours; Liège was passed in the course of the night, and Coblenz in the early morning. A full account of this trip is given by Mr. Monck Mason in his *Aeronautica* (1838). The balloon in which the journey was performed (a very large one, containing about 85,000 cubic feet of gas), was subsequently called the *Nassau Balloon*, and under that name became famous, and ascended frequently.

We ought also, perhaps, to notice a curious ascent made by Mr. Green on July 29, 1828, from the Eagle Tavern, City Road, on the back of a favorite pony. Underneath the balloon was a platform (in place of a car) containing places for the pony's feet, and some straps went loosely under his body, to prevent his lying down or moving about. Everything passed off satisfactorily, the balloon descending safely at Beckenham; the pony showed no alarm, but quietly ate some beans with which its rider supplied it in the air. Equestrian ascents

have since been repeated. In 1852, Madame Poitevin, who had made several such journeys in Paris, ascended from Cremorne Gardens, London, on horseback (as "Europa on a bull"); but after the first journey its repetition was stopped in England by application to the



The Great Nassau Balloon.

police courts, as the exhibition outraged public feeling. Lieutenant Gale was killed at Bordeaux on Sept. 8, 1850, in descending after an equestrian ascent, through mismanagement in landing of the horse. M. Poitevin, descending in 1858, after an equestrian ascent from Paris, was nearly drowned in the sea near Malaga. Among remarkable balloon ascents must also be noticed that of Mr. Wise from St. Louis, on June 23, 1859, in which a distance of 1120 miles was traversed.

In 1863, Nadar, a well-known photographer at Paris, constructed an enormous balloon, which he called "Le Géant." It was the largest gas-balloon ever constructed, containing over 200,000 cubic feet of gas. Underneath it was placed a smaller balloon, called a compensator, the object of which was to prevent loss of gas during the voyage. The car had two stories, and was, in fact, a model of a cottage in wicker work, 8 feet in height by 13 feet in length, containing a small printing-office, a photographic department, a refreshment-room, a lavatory, &c. The first ascent took place at five o'clock on Sunday, October 4, 1863, from the Champ de Mars. There were thirteen persons in the car, including one lady, the Princess de la Tour d'Auvergne, and the two aeronauts Louis and Jules Godard. In spite of the elaborate preparations that had been made and the stores of provisions that were taken up, the balloon descended at nine o'clock, at Meaux, the early descent being rendered necessary, it was said, by an accident to the valve-line.

A second ascent was made a fortnight later, viz., on October 18; there were nine passengers, including Madame Nadar. The balloon descended at the expiration of seventeen hours, near Nienburg in Hanover, a distance of about 400 miles. A strong wind was blowing, and the balloon was dragged over the ground a distance of 7 or 8 miles. All the passengers were bruised, and some more seriously hurt.

Directly after Nadar's two balloon ascents, M. Eugene Godard constructed what was perhaps the largest aerial machine that has ever been made. It was a Montgolfier or fire-balloon, of nearly half-a-million cubic feet capacity (more than double the capacity of Nadar's). The balloon *Flesselles*, 1783, is said to have slightly exceeded this size. The air was heated by an 18-foot stove, weighing, with the chimney, 980 lb. This furnace was fed by straw; and the "car" consisted of a gallery surrounding it. Two ascents of this balloon were made from Cremorne Gardens, on July 20 and July 28, 1864. This was the first fire-balloon seen by the inhabitants of London, and it was the second ascent of this kind that had been made in this country, Mr. Sneath's ascent at Mansfield having been the first, as Mr. Tytler's experiment at Edinburgh in 1784 was a leap, not an ascent, as no source of heat was taken up.

In the summer of 1873 the proprietors of the New York *Daily Graphic*, an illustrated paper, determined to construct a very large balloon, and enable Mr. Wise, the well-known American aeronaut, to realize his favorite scheme of crossing the Atlantic Ocean to Europe. It was believed by many that a current from west to east existed constantly at heights above 10,000 feet, but this seems very uncertain. Mr. Green having stated that he had met with such a current, Mr. Glaisher made a point of investigating the directions of the wind at different heights in his ascents, but found that they were as capricious as near the ground. The same result was found by others, and a comparison of the courses of the balloons sent up from Paris during the siege will show that no constant current exists. The American project came to nothing owing to the quality of the material of which the balloon was made. The size was said to be such as to contain 400,000 cubic feet, so that it would lift a weight of 14,000 lb. On September 12, 1873, during its inflation, Mr. Wise declared the material of which it was made was so bad that he could not ascend in it, though the other two persons who were to accompany him agreed to go. When, however, 325,000 feet of gas had been put into the balloon, a rent was observed, and the whole rapidly collapsed. Although this accident was greatly regretted at the time, it seems pretty certain, from what subsequently took place, that the aeronauts would not have succeeded in their object, and a serious mishap was probably avoided. On October 6, 1873, Mr. Donaldson and two others ascended from New York in the balloon after it had been repaired, and effected a perilous descent in Connecticut. In 1875 Mr. Donaldson was lost in Lake Michigan, on the occasion of an ascent from Chicago, in company with Mr. Grimwood, a reporter.

In the summer of 1887, under the patronage of Mr. Joseph Pulitzer, an enormous balloon was started from St. Louis, bearing messages from the *Post-Dispatch* to the New York *World*, both of which journals were the property of Mr. Pulitzer. Great hopes were indulged in regard to the verification of the existence of a northeasterly current of air, but these hopes were not realized, the balloon landing a few miles from its starting point. Of professional aeronauts, perhaps the best known and most successful have been Blanchard, Garnerin, the Sadlers, Mr. Charles Green, Mr. Wise, Mr. Coxwell, and the brothers Godard. Blanchard made, it is said, thirty-

six ascents, his first having taken place on March 2, 1784. His wife also made many ascents; she was killed on July 7, 1819. Garnerin is said to have ascended more than fifty times; he introduced night ascents with fireworks, &c., the first of which took place on August 4, 1807. We shall have occasion to refer to him again when we treat of parachutes. Mr. James Sadler made about sixty ascents, the first of which took place on October 12, 1784. His two sons, John and Windham, both followed in their father's steps; the latter was killed in 1817. In the minds of most Englishmen the practice of ballooning will, for a long time, be associated with the name of Mr. Charles Green, the most celebrated of English aeronauts, who, having made his first ascent on July 19, 1821, only died in the year 1870, at a very advanced age. He is credited with 526 ascents by Mr. Turner; and from advertisements, &c., we see that in 1838 he had made 249. Mr. Green may be said to have reduced ballooning to routine, and he made more ascents than any other person has ever accomplished. He accompanied Mr. Welsh in his scientific ascents, and to him is also due the invention of the *guide rope*, which he used in many of his voyages with success. It merely consisted of a rope not less than 1000 feet in length, which was attached to the ring of the balloon (from which the car is suspended), and hung down so that the end of it was allowed to trail along the surface of the ground, the object being to prevent the continual waste of gas and ballast that takes place in an ordinary balloon journey, as such an expenditure is otherwise always going on, owing to the necessity of keeping the balloon from getting either too high or too low. If a balloon provided with a guide rope sinks so low that a good deal of the rope rests on the earth, it is relieved of so much weight and rises again; if, on the contrary, it rises so high that but a little is supported by the earth, a greater weight is borne by the balloon, and equilibrium is thus produced. Mr. Green frequently used the guide rope, and found that its action was satisfactory, and that it did not, as might be supposed, become entangled in trees, &c. It was used in the Nassau journey, but more recent aeronauts have dispensed with it. Still, in crossing the sea or making a very long journey, where the preservation of the gas was of great importance, it could not fail to be valuable. Mr. Green had, in his time, more experience in the management than has fallen to the lot of any one else, and he brought to bear on the subject a great amount of skill and practical knowledge. There is also a plain matter-of-fact style about his accounts of his ascents that contrasts very favorably with the writings of some other aeronauts. Mr. Coxwell, who has made several hundred ascents, first ascended in 1844, under the name of Wells. He it was who, as aeronaut, accompanied Mr. Glaisher in most of his scientific ascents, 1862-65. The Godard family have made very many ascents in France, and are well known in all countries in connection with aeronautics. It was to two of the Godards that the management of the military balloons in the Italian campaign was entrusted; it was M. Jules Godard who succeeded in opening the valve in the dangerous descent of Nadar's balloon in Hanover in 1863, and it was Eugene Godard who constructed perhaps the largest Montgolfier ever made, an account of the ascensions of which has been given above. M. Dupuis Delcourt was also a well-known aeronaut; he has written on the subject of aerostation; his balloons were employed by MM. Bixio and Barral in their scientific ascents. In America Mr. Wise was, *par excellence*, the aeronaut; he made several hundred ascents, many of them being distinguished for much skill and daring. He also appears to have pursued his profession with more energy and capacity than has any other aeronaut in recent times, and

his *History of Aerostation* shows him to have possessed much higher scientific attainments than balloonists usually have. In fact, Mr. Wise stood alone in this respect. He was drowned in Lake Michigan on an ascension from St. Louis, in 1879.

The number of fatal accidents that have occurred in the history of balloons is not very great, and nearly all have resulted either from the use of the fire-balloon, or from want of knowledge, or carelessness on the part of the aeronauts themselves. We have already referred to the accidents that closed the careers of Philâtre de Rozier and Zambeccari. On November 25, 1802, Signor Olivari, at Orleans, and on July 17, 1812, Herr Bittorff, at Mannheim, perished in consequence of the accidental combustion of their *Montgolfières*. On April 7, 1806, M. Mosment ascended from Lille upon a platform, from which he accidentally fell and was killed. On July 7, 1819, Madame Blanchard ascended from Paris at night with fireworks attached to the car, a spark from one of which ignited the gas in the balloon, and she was precipitated to the ground and killed. Lieut. Harris ascended from London on May 25, 1824, but, through mismanagement of the valve-line, he allowed all the gas to escape suddenly from the balloon, which descended with terrible velocity. He was killed by the fall, but his companion, Miss Stocks, escaped almost uninjured. In an ascent from Blackburn on September 29, 1824, by Mr. Windham Sadler, the balloon, in rising, struck against a chimney, and the aeronaut fell over the side of the car and was killed. On July 24, 1837, Mr. Cocking descended from a balloon in a parachute, which struck the ground with such violence that he was killed on the spot. In descending with a horse on September 8, 1850, Lieut. Gale was killed; and in 1863 Mr. Chambers was killed at Nottingham, his death arising from suffocation by the gas that poured out at the neck of the balloon, which was not separated from the car by a sufficient interval.

The number of accidents that have occurred bears but a very small proportion to the number of successful ascents that have been made. Mr. Monck Mason, in his *Aeronautica*, gives a list of names, with the dates and places of their ascent, of all persons who, as far as he could find, had ascended previously to 1838. His list contains 471 names, which are distributed among the inhabitants of the different countries as follows:—England, 313; France, 104; Italy, 18; Germany and the German States, 17; Turkey, 5; Prussia, 3; Russia, 2; Poland, 2; Hungary, 2; Denmark, 1; Switzerland, 1; and the United States, 3. Among these are the names of 49 women, of whom 28 are English, 17 French, 3 German, and 1 Italian. Some of the persons had ascended a great number of times; thus Mr. Charles Green's ascents alone amounted to more than 249; and those of the members of the same family to 535. Mr. Mason calculated that the whole number of ascents executed by Englishmen was 752. Of the 471 adventurers only nine were killed, and of these six owed their fate to the dangers of the fire-balloon, and one to bravado.

We can call to mind but six fatal casualties that have taken place since Mr. Mason compiled his list, viz. Mr. Cocking's parachute accident, Mr. Gale's death in 1850, Mr. Chambers' death in 1863, Donaldson and Grimwood's in 1875, and Wise's in 1879.

We come now to an account of the use to which the balloon has been applied for the advancement of science. The ascents that have been made are by Scharof, Biot, and Gay-Lussac in 1804, by Bixio and Barral in 1850, by Mr. Welsh in 1852, by Mr. Glaisher in 1862-66, and MM. Flammarion and De Fonvielle in 1867-68. We shall give a brief account of these ascents, because, as has been remarked, with a few exceptions, they form the

only useful purpose to which the balloon has been applied. The general description of the phenomena, &c., met with in a high ascent, and the general results found, are referred to in the account of Mr. Glaisher's experiments, as not only are his accounts more detailed, but the number of ascents made by him is much in excess of that of all the others put together.

The Academy of Sciences at St. Petersburg, entertaining the opinion that the experiments made on mountain-sides by De Luc, De Saussure, Humboldt, and others must give results different from those made in free air at the same heights, resolved in 1803 that a balloon ascent should be made for the purpose of making scientific researches. Accordingly, on January 30, 1804, M. Sacharof, a member of the academy, ascended, with M. Robertson as aeronaut, in a balloon belonging to the latter, which was inflated with hydrogen gas. The ascent was made at a quarter past seven, and the descent effected at a quarter to eleven. No great height was reached, as the barometer never sank below 23 in., corresponding to less than $1\frac{1}{2}$ mile. The experiments were not very systematically made, and the chief results were the filling and bringing down several flasks of air collected at different elevations, and the supposed observation that the magnetic dip was altered. A telescope was fixed in the bottom of the car pointing vertically downwards, so that the travellers might be able to ascertain exactly the spot over which they were floating at any moment. M. Sacharof found that, on shouting downwards through his speaking-trumpet, the echo from the earth was quite distinct, and at his height was audible after an interval of about ten seconds.

At the commencement of 1804 Laplace proposed to the members of the French Academy of Sciences that balloons should be employed for the purpose of solving certain physical problems, adding that, as the government had placed funds at their disposal for the prosecution of useful experiments, he thought they might be well applied to this kind of research.

On August 24, 1804, MM. Gay-Lussac and Biot ascended from the Conservatoire des Arts at ten o'clock in the morning. Their magnetic experiments were incommoded by the rotation of the balloon, but they found that, up to the height of 13,000 feet, the time of vibration of a magnet was appreciably the same as on the earth's surface. They found also that the air became drier as they ascended. The height reached was about 13,000 feet, and the temperature declined from 63° Fahr. to 51° .

In a second experiment, which was made on September 16, 1804, M. Gay-Lussac ascended alone. The chief result obtained was that the magnetic force, like gravitation, did not experience any sensible variation at heights from the earth's surface which we can attain to. Gay-Lussac also brought down air collected at the height of nearly 23,000 feet, and on analysis it appeared that its constitution was the same as that of air collected at the earth's surface.

At the meeting of the British Association for the Advancement of Science, held at Aberdeen in 1859, a committee was appointed for the purpose of making observations in the higher strata of the atmosphere by means of the balloon. For the first two years nothing was effected, owing to the want both of an observer and of a suitable balloon. It will be enough, after explaining the objects of the experiments, &c., to describe briefly one or two of the most remarkable ascents, and then state the kind of conclusions that follow from them as a whole.

The primary object was to determine the temperature of the air, and its hydrometrical state at different elevations to as great a height as could be reached; and the

secondary objects were — (1) to determine the temperature of the dew-point by Daniell's and Regnault's hygrometers, as well as by the dry and wet bulb thermometers, and to compare the results; (2) to compare the readings of an aneroid barometer with those of a mercurial barometer up to the height of 5 miles; (3) to determine the electrical state of the air; (4) the oxygenic condition of the atmosphere, and (5) the time of vibration of a magnet; (6) to collect air at different elevations; (7) to note the height and kind of clouds, their density and thickness; (8) to determine the rate and direction of different currents in the atmosphere; and (9) to make observations on sound.

The instruments used were mercurial and aneroid barometers, dry and wet bulb thermometers, Daniell's dew-point hygrometer, Regnault's condensing hygrometer, maximum and minimum thermometers, a magnet for horizontal vibration, hermetically sealed glass tubes exhausted of air, and an electrometer. In one or two of the ascents a camera was taken up.

The first ascent was made, as has been stated, from Wolverhampton on July 17, 1862, and the journey was remarkable on account of a warm current that was met with at a great elevation. The balloon left at 9:43 A. M., and a height of 3800 feet was reached before an observation could be taken. The temperature of the air at starting was 59° Fahr., at 4000 feet it was 45° , and it descended to 26° at 10,000 feet, from which height to that of 13,000 feet there was no diminution. While passing through this space Mr. Glaisher put on additional clothing, feeling certain that a temperature below zero would be attained before the height of 5 miles was reached; but at the elevation of 15,500 feet the temperature was 31° , and at each successive reading, up to 19,500, it *increased*, and was there 42° . The temperature then decreased rapidly, and was 16° at 26,000 feet. On descending it increased regularly to $37^{\circ}\cdot8$ at 10,000 feet.

The weather on the day (Aug. 18, 1862) of the third ascent was favorable, and there was but little wind. All the instruments were fixed before leaving the earth. A height of more than 4 miles was attained, and the balloon remained in the air about two hours. When at its highest point there were no clouds between the balloon and the earth, and the streets of Birmingham were distinctly visible. The descent was effected at Solihull, 7 miles from Birmingham. On the earth the temperature of the air was $67^{\circ}\cdot8$, and that of the dew-point $54^{\circ}\cdot6$; and they steadily decreased to $39^{\circ}\cdot5$ and $22^{\circ}\cdot2$ respectively at 11,500 feet. The balloon was then made to descend to the height of about 3000 feet, when both increased to $56^{\circ}\cdot0$ and $47^{\circ}\cdot5$ respectively. On throwing out ballast the balloon rose again, and the temperature declined pretty steadily to $24^{\circ}\cdot0$, and that of the dew-point to $-10^{\circ}\cdot0$, at the height of 23,000 feet. During this ascent Mr. Glaisher's hands became quite blue, and he experienced a qualmish sensation in the brain and stomach, resembling the approach of sea-sickness; but no further inconvenience, besides such as resulted from the cold and the difficulty of breathing, was experienced. This feeling of sickness never occurred again to Mr. Glaisher in any subsequent ascent.

In the years 1867 and 1868 M. Flammarion made eight or nine ascents from Paris for scientific purposes. The heights reached were not great, but the general result of the observations was to confirm those made by Mr. Glaisher. See M. Flammarion in *Voyages Aériens*, Paris, 1870, or *Travels in the Air*, London, 1871. Observations were also made in some balloon ascents by M. de Fonvielle, which are noticed in the works just referred to.

The balloon had not been discovered very long before

it received a military status, and soon after the commencement of the French revolutionary war an aeronautic school was founded at Meudon; Guyton de Morveau, the chemist, and Colonel Coutelle being the persons in charge. Four balloons were constructed for the armies of the north, of the Sambre and Meuse, of the Rhine and Moselle, and of Egypt. In June 1794 Coutelle ascended with the adjutant and general to reconnoitre the hostile army just before the battle of Fleurus, and two reconnaissances were made, each occupying four hours. It is generally stated that it was the information so gained that the French victory was due. The balloon corps was in constant requisition during the campaign, but it does not appear that, with the exception of the reconnaissances just mentioned, any great advantages resulted, except in a moral point of view. But even this was of importance, as the enemy were much disconcerted at having their movements so completely watched, while the French were correspondingly elated at the superior information it was believed they were gaining. An attempt was made to revive the use of balloons in the African campaign of 1830, but no opportunity occurred in which they could be employed. It is said that in 1849, a reconnoitring balloon was sent up from before Venice, and that the Russians used one at Sebastopol. In the French campaign against Italy in 1859, the French had recourse to the use of balloons, but this time there was not any aerostatic corps, and their management was entrusted to the brothers Godard. Several reconnaissances were made, and one of especial interest the day before the battle of Solferino. No information of much importance seems, however, to have been gained thereby. The Fleurus reconnaissance was made in a balloon inflated with hydrogen gas, while at Solferino a fire-balloon was employed. Each system has its advantages and disadvantages; the gas-balloon requires several hours for inflation, but then it can remain in the air any length of time; the fire-balloon can be inflated rapidly, but it will not stay in the air more than five or ten minutes unless a furnace is taken up, the use of which is impracticable in even a moderate wind; besides, the fire-balloon must be of very large dimensions, and only one person could, as a rule, ascend at a time, and he would have to be occupied with the fire: the use of fire-balloons also is always attended with some danger. M. Eugene Godard, who was engaged in the management of the balloons in the Italian campaign, wrote to the *Times*, in August 1864, expressing his opinion of the superiority of fire-balloons for war purposes, as they are so easily inflated and are not destroyed or compelled to descend even if pierced by several balls; and this was also, we believe, the opinion of the Austrians who made experiments with war balloons.

In the late American war balloons were a good deal used by the Federals. There was a regular balloon staff attached to McClellan's army, with a captain, an assistant-captain, and about 50 non-commissioned officers and privates. The apparatus consisted of two generators, drawn by four horses each; two balloons, drawn by four horses each, and an acid-cart, drawn by two horses. The two balloons used contained about 13,000 and 26,000 feet of gas, and the inflation usually occupied about three hours.

When the Montgolfiers first discovered the balloon, its great use in military operations was at once prophesied; but these anticipations have not been realised. On the other hand, however, there can be no doubt that the balloon has never had a fair trial, being viewed coldly by officers enamoured of routine, and when used, being often left unsupplied with suitable appointments. It is

probable that a future still remains for the balloon in this direction.

The paramount value of the balloon during the recent siege of Paris must be fresh in the minds of all. It was by it alone that communication was kept up between the besieged city and the external world, as the balloons carried away from Paris the pigeons which afterwards brought back to it the news of the provinces. The total number of balloons that ascended from Paris during the siege, conveying persons and dispatches, was sixty-four—the first having started on September 23, 1870, and the last on January 28, 1871. Gambetta effected his escape from Paris, on October 7, in the balloon *Armand-Barbès*, an event which doubtless led to the prolongation of the war. Of the sixty-four balloons only two were ever heard of; they were blown out to sea. One of the most remarkable voyages was that of the *Ville d'Orléans*, which, leaving Paris at eleven o'clock on November 21, descended fifteen hours afterwards near Christiania, having crossed the North Sea. Several of the balloons on their descent were taken by the Prussians, and a good many were fired at while in the air; but we do not hear of any being injured from this cause. The average size of the balloons was from 2000 to 2050 metres, or from 70,000 to 72,000 cubic feet. The above facts we have extracted from *Les Ballons du Siège de Paris*, a sheet published by Bulla & Sons, Paris; compiled by the brothers Tissandier, well known French aeronauts, and giving the name, size, and times of ascent and descent of every balloon that left Paris, with the names of the aeronaut and generally also those of the passengers, the weight of despatches, the number of pigeons, &c. Only those balloons, however, are noticed in which some person ascended.

The principle of the parachute is so simple that the idea must have occurred to persons in all ages. Father Loubere, in his History of Siam, published two centuries ago, tells of a person who frequently diverted the court by the prodigious leaps he used to take, having two parachutes or umbrellas fastened to his girdle. In 1783 a certain M. le Normand practically demonstrated the efficiency of a parachute by descending from a high house at Lyons; but he merely regarded it as a useful means whereby to escape from fire. To Blanchard is due the idea of using it as an adjunct to the balloon. As early as 1785 he had constructed a parachute, to which was attached a basket. In this he placed a dog, which descended safely to the ground when the parachute was released from a balloon at a considerable elevation. It is stated that he descended himself from a balloon in a parachute in 1793; but, owing to some defect in its construction, he fell too rapidly, and broke his leg.

André Jaques Garnerin was the first person who successfully descended from a balloon in a parachute, and he repeated this experiment so often that he may be said to have first demonstrated the practicability of using the machine; and, in fact, that he invented it in practical and suitable form. In 1793 Garnerin had been taken prisoner at Marchiennes, and he was confined for between two and three years in the fortress of Bude, in Hungary. While in captivity he elaborated in his mind the means of descending from a balloon by means of a parachute; and on October 22, 1797, he made his first public experiment. He ascended from the park of Monceau at Paris, and when at the height of about $1\frac{1}{4}$ mile he released the parachute, which was attached to the balloon in place of a car; the balloon, relieved suddenly of so great a weight, rose very rapidly till it burst, while the parachute descended very fast, making violent oscillations all the way. Garnerin, however, reached the earth in safety upon the plain of Monceau. In 1802 Garnerin went to England and made a good many ascents in all parts of

the country, many of which excited much enthusiasm, as can be seen from the contemporary accounts; and on September 21, 1802, he repeated his parachute experiment in England.

The parachute was dome-shaped, and bore a resemblance to a large umbrella. The case or dome was made of white canvas, and was 23 feet in diameter. At the top was a truck or round piece of wood 10 inches in diameter, with a hole in its centre, fastened to the canvas by 32 short pieces of tape. The parachute was suspended from a hoop attached to the netting of the balloon, and below the parachute was placed a cylindrical basket, 4 feet high and $2\frac{1}{4}$ feet in diameter, which contained the aeronaut. The ascent took place at about six o'clock from North Audley Street, London; and, at a height of about (it is believed) 8,000 feet, Garnerin separated the parachute from the balloon. For a few seconds his fate seemed certain, as the parachute retained the collapsed state in which it had originally ascended, and fell very rapidly. It suddenly, however, expanded, and the rapidity of its descent was at once checked, but the oscillations were so violent that the car, which was suspended 20 feet below, was sometimes on a level with the rest of the apparatus. Some accounts state that these oscillations increased, others that they decreased as the parachute descended, and the latter seems most probable. It came to the ground in a field at the back of St. Pancras Church, the descent having occupied rather more than ten minutes. Garnerin was hurt a little by the violence with which the basket containing him struck the earth; but a few cuts and a slight nausea represented all the ill effects of his fall.

Jordaki Kuparento, a Polish aeronaut, is the only person who ever made any real use of a parachute. He ascended from Warsaw on July 24, 1808, in a fire-balloon, which, at a considerable elevation, took fire; but being provided with a parachute, he was enabled to effect his descent in safety.

The next experiment made with a parachute was that which resulted in the unfortunate death of Mr. Robert Cocking. So early as 1814 this gentleman had lectured on the subject before the City Philosophical Society, and also before the Society of Arts. He always retained an interest in ballooning, and made two ascents—one with Mr. Sadler, and the other on September 27, 1836, with Mr. Green. The success of the balloon trip of Messrs. Hollond, Mason, and Green, seems to have incited Mr. Cocking to demonstrate practically the truth of his views. He accordingly constructed a suitable parachute on his principles, and having succeeded in obtaining the consent of Messrs. Hughes and Gye, the proprietors of Vauxhall Gardens, to permit the ascent to be made there, he prevailed on Mr. Green to ascend in his great Nassau balloon, with the parachute attached. The great defect of Garnerin's umbrella-shaped parachute was its violent oscillation during descent, and Mr. Cocking considered that, if the parachute were made of a conical form (vertex downwards), the whole of this oscillation would be avoided; and if it were made of sufficient size, there would be resistance enough to check too rapid a descent. He therefore constructed a parachute on this principle, the radius of which at its widest part was about 17 feet. It was stated in the public announcements previous to the experiment that the whole weighed 223 lb; but from the evidence at the inquest it appeared that the weight must have been over 400 lb. Mr. Cocking's weight was 177 lb, which was so much additional. On July 24, 1837, the trial took place; and the Nassau balloon, with Mr. Green and Mr. Spencer, a solicitor, in the car, and having suspended below it the parachute, in the car of which was Mr. Cocking, rose from the ground at twenty-five minutes to eight in the evening. A good

deal of difficulty was experienced in rising to a suitable height, partly in consequence of the resistance to the air offered by the expanded parachute, and partly owing to its weight. Mr. Cocking wished the height to be 8000

feet; but when the balloon reached the height of 5000 feet, it being then nearly over Greenwich, Mr.

Green called out to Mr. Cocking that he should be unable to ascend to the requisite height if the parachute was to descend in daylight. Mr. Cocking accordingly let slip the catch which was to liberate him from the balloon.



Cocking's Parachute.

The parachute for a few seconds descended very rapidly, but still evenly, until suddenly the upper rim seemed to give way, and the whole apparatus collapsed (taking a form resembling an umbrella turned inside out, and nearly closed), and the machine descended with great rapidity, oscillating very much. When about two or three hundred feet from the ground, the basket became disengaged from the remnant of the parachute, and Mr. Cocking was found in a field at Lee, literally dashed to pieces.

Mr. Green and Mr. Spencer, who were in the car of the balloon, had also a narrow escape. At the moment the parachute was disengaged they crouched down in the car, and Mr. Green clung to the valve-line, to permit the escape of the gas. The balloon shot upwards, plunging and rolling, and the gas pouring from both the upper and lower valves, but chiefly from the latter, as the great resistance of the air checked its egress from the former. Mr. Green and Mr. Spencer applied their mouths to tubes communicating with an air-bag with which they had had the foresight to provide themselves, otherwise they would certainly have been suffocated by the gas. Notwithstanding this precaution, however, the gas almost totally deprived them of sight for four or five minutes. When they came to themselves they found they were at a height of about four miles, and descending rapidly. They effected, however, a safe descent near Maidstone.

In 1839 Mr. Hampton made three descents in a parachute, on Garnerin's pattern, from his balloon, the "Albion." He followed Garnerin's example in attaching the parachute to the netting of the balloon, so that when the connection between the two was severed the latter was left to its own devices. Mr. Hampton took measures, however, that it should descend soon after the parachute, and it was generally found no great distance off, and returned to him. All his parachute descents were safely performed, although in one he was a good deal shaken.

Numerous attempts have been made both to direct balloons and contrive independent flying machines. After the invention of the balloon by the brothers Montgolfier, it was at once thought that no very great difficulty would be found in devising a suitable steering apparatus; in fact, it was supposed that to rise into the air and remain there was the chief difficulty, and that, this being accomplished, the power of directing the aerostat would be a secondary achievement that must follow before long.

Accordingly, in most of the early balloons the voyagers took up oars, sails, or paddles, which they diligently worked while in the air; sometimes they thought an effect was produced, and some-times not.

If we consider the number of different currents in the atmosphere, it is no wonder that some should have announced with confidence that their course



Hampton's Parachute.

was changed from that of the wind by means of the sails or oars that they used; in fact, it is not very often that the whole atmosphere up to a considerable height is moving *en masse* in the same direction, so that generally the course taken by the balloon, as determined merely by joining the places of ascent and descent, is not identical with the direction of the wind, even when it is the same at both places. Although there is no reason why balloons should not be so guided by means of mechanical appliances attached to them as to move in a direction making a small angle with that of the wind, still it must have been evident to any one who has observed a balloon during inflation on a windy day, that any motion in which it would be exposed to the action of a strong current of air must result in its destruction. It has therefore gradually become recognized that the balloon is scarcely a step at all towards a system of aerial navigation; and many have thought that the principles involved in the construction of a flying machine must be very different from the simple statical equilibrium that subsists when a balloon is floating in the air. "To navigate the air the machine must be heavier than the air," has frequently been regarded as an axiom; and there can be no doubt that an apparatus constructed of such light material as is necessary for a balloon must either be destroyed or become ungovernable in a high wind. Recently, however, M. Dupuy de Lôme, an eminent French engineer, has constructed and made experiments with a balloon which he considers satisfies some of the conditions. The balloon is spindle-shaped, the longer axis being horizontal, and it contains about 120,000 cubic feet. The car is suspended below the middle of the balloon, and there are provided a rudder and a screw. The rudder consists of a triangular sail placed beneath the balloon and near the rear, and is kept in position by a horizontal yard, about 20 feet long, turning round a pivot in its forward extremity; the height of the sail is 16 feet, and its surface 160 square feet. Two ropes for working the rudder extend forward to the seat of the steerer, who has before him a compass fixed to the car, the central part of which will contain fourteen men. The screw is carried by the car, and is driven by four or eight men working at a capstan. A trial was made with the machine on February 2, 1872, on a windy day, and M. de Lôme considered that he had been enabled by his screw and rudder to alter his course about 12°. (*See Report of the Aeronautical Society, 1872.*)

Of flying machines, in which both buoyancy and motion were proposed to be obtained by purely mechanical means, the number has been very great. Most of the projects have been chimerical, and were due to persons

possessed of an insufficient knowledge of the principles of natural philosophy, both theoretically and practically. They serve, however, to show how great a number of individuals must have paid attention to the matter, and even at the present time several patents are taken out annually on the subject. We do not propose here to give an account of any of these projects, for but few have ever passed beyond projects, but will merely refer to Mr. Henson's aerial carriage, which in 1843 attracted some attention. The apparatus was an elaborate one, and its principal feature was the great expanse of the sustaining planes. The machine was to advance with its front edge a little raised, the effect of which would be to present its under surface to the air over which it was passing; the resistance of this air, acting on it like the strong wind on the sails of a windmill, would, it was thought, prevent the descent of the machine. Mr. Henson invented a steam-engine of great lightness, but he proposed that the machine should be started down an inclined plane, so that the steam-engine would only have to make up for the velocity lost by the resistance of the air. The scheme never came to anything.

In 1865 the Aeronautical Society of Great Britain was founded, the officers being—President, the Duke of Argyle; Treasurer, Mr. J. Glaisher; and Secretary, Mr. Brearey. It has published an annual report every year since then, containing selections from the papers read to the society, and abstracts of the discussions that took place thereon at the meetings. The numerous papers submitted to this society bear witness to the great number of minds that are engaged on the solution of the problem of aerial navigation. Of course not a few of the methods proposed are the fanciful projects of ignorant men, but some show the careful thought and elaborate experiment of trained engineers and other qualified persons. In 1868 the society held an exhibition of flying machines, &c., at the Crystal Palace, which was visited by many persons. A fire-balloon of a M. de la Marne, which should have ascended, caught fire and was burnt. In 1871 a series of experiments was made at Penn's factory (Greenwich) on the resistance of different shaped plans placed at different angles, in a current of air produced by a rotary fan. Investigations of this kind not only form the first step toward obtaining data for a true knowledge of the exact nature of flying, but are also independently, of high scientific interest. The chief object of the society is to bring together those persons who are interested in the subject of aeronautics (except balloonists by trade who are ineligible), and to encourage those who, possessing suitable acquirement, are devoting their time to the investigation of the question.

Aerostatic societies have also been founded in other countries; but although they have been inaugurated with considerable *éclat*, more than one have already terminated a short-lived career. The Vienna society seems, however, to have been unusually active during the national exhibition of 1873.

In actual aerostation, as at present practised, ordinary coal gas is used, which is many times heavier than hydrogen, being, in fact, usually not less than half the specific gravity of air. Even when balloons are inflated with hydrogen, generated by the action of sulphuric acid on zinc filings, the gas is very far from pure, and its density is often double that of pure hydrogen, and even greater.

The hydrostatic laws relating to the equilibrium of floating bodies were known long previous to the invention of the balloon in 1783, but it was only in the latter half of the 18th century that the nature of gases was sufficiently understood to enable these principles to have been acted on. As we have seen, both Black and Cavallo did make use of them on a small scale, and if they had

thought it possible to make a varnish impervious to the passage of hydrogen gas they could have easily anticipated the Montgolfiers. As it was, no sooner was the fire-balloon invented, than Charles at once suggested and practically carried out the idea of the hydrogen or inflammable air balloon.

The mathematical theory of the rate of ascent of a balloon possesses remarkable historic interest, from the fact that it was the last problem that engaged the attention of the greatest mathematician of the last century, Euler. The news of the experiment of the Montgolfiers at Annonay on June 5, 1783, reached the aged mathematician (he was in his 77th year) at St. Petersburg, and with an energy that was characteristic of him he at once proceeded to investigate the motion of a globe lighter than the air it displaced. For many years he had been all but totally blind, and was in the habit of performing his calculations with chalk upon a black board. It was after his death, on September 7, 1783, that this board was found covered with the analytical investigation of the motion of an aerostat. This investigation is printed under the title, *Calculs sur les Ballons Aérostatiques faits par feu M. Léonard Euler, tels qu'on les a trouvés sur son ardoise, après sa mort arrivée le 7 Septembre 1783, in the Memoirs of the French Academy for 1781* (pp. 264–268). The explanation of the earlier date is that the volume of memoirs for 1781 was not published till 1784. The peculiarity of Euler's memoir is that it deals with the motion of a closed globe filled with a gas lighter than air, whereas the experiments of the Montgolfiers were made with balloons inflated with heated air. The explanation of this must be that either an imperfect account reached Euler, and that he supplied the details himself as seemed to him most probable, or that he, like the Montgolfiers themselves, attributed the rising of the balloon to the generation of a special gas given off by the chopped straw with which the fire was fed. The treatment of the question by Euler presents no particular point of importance—indeed, it could not; but the fact of its having given rise to the closing work of so long and distinguished a life, and having occupied the last thoughts of so great a mind, confers on the problem of the balloon's motion a peculiar interest.

The chief danger attending ballooning lies in the descent; for if a strong wind be blowing, the grapnel will sometimes trail for miles over the ground at the rate of ten or twenty miles an hour, catching now and then in hedges, ditches, roots of trees, &c.; and, after giving the balloon a terrible jerk, breaking loose again, till at length some obstruction, such as the wooded bank of a stream, affords a firm hold. If the balloon has lost all its buoyant power by the escape of the gas, the car also drags over the ground. But even a very rough descent is usually not productive of any very serious consequences; as, although the occupants of the car generally receive many bruises, and are perhaps cut by the ropes, it rarely happens that anything worse occurs. On a day when the wind is light (supposing that there is no want of ballast) nothing can be easier than the descent, and the aeronaut can decide several miles off on the field in which he will alight. It is very important to have a good supply of ballast, so as to be able to check the rapidity of the descent, as in passing downward through a wet cloud the weight of the balloon is enormously increased by the water deposited on it; and, if there is no ballast to throw out to compensate this accession of mass, the velocity is sometimes very great. It is also convenient, if the district upon which the balloon is descending appear unsuitable for landing, to be able to rise again. The ballast consists of fine baked sand, which becomes so scattered as to be inappreciable before it has fallen far below the balloon. It is taken up in bags containing about $\frac{1}{2}$ cwt.

each. The balloon at starting is liberated by a spring catch which the aeronaut releases, and the ballast should be so adjusted that there is nearly equilibrium before leaving, else the rapidity of ascent is too great, and has to be checked by parting with gas. It is almost impossible to liberate the balloon in such a way as to avoid giving it a rotary motion about a vertical axis, which continues during the whole time it is in the air. This rotation makes it difficult for those in the car to discover in what direction they are moving; and it is only by looking down along the rope to which the grapnel is suspended that the motion of the balloon over the country below can be traced. We may mention that the upward and downward motion at any instant is at once known by merely dropping over the side of the car a small piece of paper: if the paper ascends or remains on the same level or stationary, the balloon is descending; while, if it descends, the balloon is ascending. This test is so delicate that it sometimes showed the motion at a particular instant with more precision than did Mr. Glaisher's very delicate instruments.

Contrivances are often proposed by which the valve might be opened in less crude ways than by merely pulling a string attached to it; by which the jerks produced by the catching of the grapnel might be diminished, &c. These improvements are not adopted, because simplicity is requisite before everything. Any mechanical contrivance might be broken and rendered useless by the first blow of the car on the earth; whereas the primitive arrangements in use are such that scarcely any rough treatment can impair their efficiency.

The most important works that have appeared on the the subject of aeronautics are—

Dædalus, or Mechanical Motions, by Bishop Wilkins, London, 1648; *A Treatise on the Nature and Properties of Air and other Permanently Elastic Fluids*, by Tiberius Cavallo, London, 1781; *Account of the First Aerial Voyage in England, in a Series of Letters to his Guardian*, by Vincent Lunardi, London, 1784; *History and Practice of Aeronautics*, by Tiberius Cavallo, London, 1785; *Annals of some Remarkable Aerial and Alpine Voyages, including those of the author*, by T. Forster, London, 1832; *Aeronautica, by Monck Mason*, London, 1838; *A System of Aeronautics, comprehending its Earliest Investigations*, by John Wise, Philadelphia, 1850; *Astra Castra, Experiments and Adventures in the Atmosphere*, by Hatton Turnor, London, 1865; *Voyages Aériens*, par J. Glaisher, C. Flammarion, W. de Fonvielle, et G. Tissandier, Paris, 1870; the same translated into English and published, edited by James Glaisher, under the title, *Travels in the Air*, London, 1871.

ÆRTSZEN, PIETER, called "Long Peter" on account of his height, an historical painter of great merit as regards both drawing and coloring, was born at Amsterdam in 1520, and died in 1573. Several of his best works—alto-pieces in various churches—were destroyed in the religious wars of the Netherlands. An excellent specimen of his style on a small scale, a picture of the crucifixion, may be seen in the Antwerp Museum.

ÆS is commonly translated *brass*, but the æs of the Romans, was used to signify not only pure copper, but also a *bronze*, or alloy of copper and tin. The cutting instruments of the ancient Greeks, Romans, and Egyptians were originally of bronze. The Romans borrowed their arms, as well as their money, from the Etruscans. Analysis of the bronzes of these nations shows that they contained about 12 per cent. of tin, which gave them hardness and capability of receiving a good edge. As the most ancient coined money of the Romans was of copper or bronze, æs came to be used for money in gen-

eral, even after the introduction of silver and gold coinage.

ÆSCHINES, an Athenian philosopher, said to be the son of a sausage-maker. He was continually with Socrates; which occasioned that philosopher to say that the sausage-maker's son was the only person who knew how to pay a due regard to him.

ÆSCHINES, a celebrated Grecian orator, was born in Attica 389 years before the Christian era. His services as a soldier, and his talents, which were considerable, procured him great applause; and, as a public speaker, he became a formidable rival to Demosthenes himself. Three only of his orations are extant. His eloquence is of a very high order, and as an orator he is second only to Demosthenes. He died 314 B. C.

ÆSCHYLUS, the father of the Greek tragic drama, was born in the year 525 B.C., in the Attic demos of Eleusis. The period of his youth and manhood coincides, therefore, with that great uprising of the national spirit of the Greeks, caused by the successive attempts of Darius, king of Persia, and his son Xerxes, to enslave their European neighbors on the north and west shores of the *Ægean*. The father of Attic tragedy helped, in the year 490, to drive the captains of Darius into the marshes of Marathon, and, ten years later, encompassed with ruin the multitudinous armament of Xerxes within the narrow strait of Salamis. He composed seventy plays, and gained the prize for dramatic excellence thirteen times. The Athenians esteemed his works so highly as to allow some of them to be represented after his death,—a privilege, in their dramatic practice, altogether anomalous. He died at Gela, in Sicily, in the sixty-ninth year of his age. Of the seventy plays which an old biographer reports him to have composed, only seven remain, with a few fragments of little significance save to the keen eye of the professed philologist. These fragments, however, are sufficient to justify the high esteem in which he was held by the Athenian public, and by that greatest of all the great wits of a witty age and a witty people, Aristophanes. In the grand trilogy which exhibits, in three consecutive tragedies, the story of the murder of Agamemnon, and its moral sequences, we have a perfect specimen of what the Greek tragedy was to the Greeks, as at once a complex artistic machinery for the exhibition of national legend, and a grave pulpit for the preaching of important moral truths; nor could a more worthy founder than *Æschylus* of such a "sacred opera" be imagined.

ÆSCULAPIUS, in the *Heathen Mythology*, the god of medicine, was the son of Apollo and the nymph Coronis. He was educated by the centaur Chiron, who taught him the art of healing; and his skill enabled him to cure the most desperate diseases. But Jupiter, enraged at his restoring to life Hippolytus, who had been torn in pieces by his own horses, killed him with a thunderbolt. At *Epidauros*, *Æsculapius's* statue was of gold and ivory, with a long beard, the head surrounded with rays, a knotty stick in one hand, and the other entwined with a serpent: the figure was seated on a throne of the same materials as the statue, and had a dog lying at its feet. The Romans crowned him with laurel, to represent his descent from Apollo; and the Phliasiens represented him as beardless. The cock, raven, and the goat were sacred to this deity. In many places votive tablets were hung up, showing the names of those cured and the diseases of which they were healed by his assistance.

ÆSIR, the gods of the Northmen of Scandinavia and Iceland. There were twelve chief gods or *Æsir* besides Odin, Thor, Baldur, Njörd, Frey, Ty or Tyr, Bragi, Heimdal, Höd, Vidar, Ull, Forseti, Loki or Lopt. The chief goddesses were—Frigg, Freyia, Nanna, Sif, Saga,

Hel, Gefion, Eir, Hlin, Lofn, Vör, Snotra. The names of the *Æsir*, considered in the primary old northern significance of the words, convey in most instances an allusion to their characteristics; but it is impossible to decide whether they merely personify certain physical powers in nature, and abstract ideas of definite mental conditions, or whether they were originally borne by individuals connected with the pre-historic ages of the people. Our knowledge of northern mythology has been derived principally from the fragmentary remains of ancient Scandinavian songs, first collected in Iceland in the 11th century, and embodied in the 13th century with numerous other prose and poetic myths in a compilation now known to us as the *Eddas*.

In *Thor*, who seems to have been a god of that earlier Phœnician form of nature-worship which was superseded in Scandinavia and Northern Germany by the faith of Odin, we have the impersonation of the disturbing and destructive agencies in the universe. He is the son of heaven and earth—of Odin, the All-father, and of Frigg or Fjörgvin, the vivifying—and is the strongest of the *Æsir*. From his hammer flashed the lightning, and his chariot wheels sent thunder rolling through the clouds as he went on his way, cleaving mountains, loosening the pent-up streams and fires, and slaying all giants and misshapen monsters. With his mallet he consecrated the newly-wedded, and hence the sign of the mallet or hammer was made by the Northmen when they took an oath and bound themselves by vows, whether of marriage or any other obligation. The early Christian missionaries of Norway, finding the faith in Thor too strong to be suddenly uprooted, tried to transfer many of his characteristics to their zealous royal convert, St. Olaf, who was said to have resembled the old northern god in his comeliness of person, his bright red beard, hot, angry temper, and personal strength; while some of the monks of a later period endeavored to persuade the Northmen that in Thor their forefathers had worshipped the Christ, the strong and mighty Saviour of the oppressed, and that his mallet was the rude image of the cross.

In *Baldur* the Northmen honored all that was beautiful, eloquent, wise, and good, and he was the spirit of activity, joy, and light; but his name signifies the strong in mind.

From this brief outline it may be seen that in their *Æsir* the Northmen recognised the creators, sustainers, and regulators of the world as it now is, from whom emanated the thought and life that pervade and animate all nature, and the efforts to subject it to the spiritual will. With Odin and the *Æsir* the intellectual life of the northern people began; and although they ascribe to them human forms and acts, these were seldom without something higher and nobler than what pertains to mortals; and while they recognised the existence of a state of chaos and darkness before this world began with the creation of the *Æsir*, they anticipated the advent of another state, in which gods, like men, would receive their award at the hands of a supreme All-father.

ÆSOP, the fabulist, is supposed to have been born about the year 620 B.C., but the place of his birth is uncertain, that honor being claimed alike by Samos, Sardis, Mesembria in Thrace, and Cotiæum in Phrygia. He was brought, while young, to Athens as a slave, and having served several masters, was eventually enfranchised by Iadmon the Samian. He thereupon visited Croesus, king of Lydia, at whose court he is represented by Plutarch as reproving Solon for his discourteous manner towards the king. During the usurpation of Pisistratus he is said to have visited Athens, and composed the fable of *Jupiter and the Frogs* for the instruction of the citizens (Phædrus, i. 2). As the ambassador of Croesus at Delphi, he was charged with

the payment of a large sum of four minæ to each of the citizens; but in consequence of some dispute, he declined to distribute the money. The Delphians, incensed at his conduct, accused him of sacrilege, and threw him headlong from a precipice, about 564 B. C.

None of Æsop's works are extant. The popular stories regarding him are derived from a life prefixed to a book of fables purporting to be his, collected by Maximus Planudes, a monk of the 14th century. Whether Æsop left any written fables has been justly disputed, and Bentley inclines to the negative. Thus Aristophanes represents Philocleon as learning his fables in conversation, and not from a book; and Socrates essayed to versify such as he remembered. Others again, are of opinion that a collection had been made of them before Socrates. It is, however, certain that fables bearing Æsop's name were popular at Athens during the most brilliant period of its literary history. A complete collection of the Æsopian fables, 231 in number, was published at Breslau, by J. G. Schneider, in 1810.

ÆSOP, a Greek historian, whose life of Alexander the Great is preserved in a Latin translation by Julius Valerius.

ÆSOP, CLODIUS, a celebrated actor, who flourished about the 670th year of Rome. He and Roscius were contemporaries, and the best performers who ever appeared upon the Roman stage; the former excelling in tragedy, the latter in comedy. Cicero was on intimate terms with both actors, and put himself under their direction to perfect his action. Æsop made his last appearance on the stage in B. C. 55, at the dedication of Pompey's theatre, on which occasion his voice failed him. The son of Æsop took a pearl from the eardrop of Cæcilia Metella, and dissolved it in vinegar, that he might have the satisfaction of swallowing eight thousand pounds' worth at a draught.

ÆSTHETICS is the term now employed to designate the theory of the Fine Arts—the science of the Beautiful, with its allied conceptions and emotions. The province of the science is not, however, very definitely fixed, and there is still some ambiguity about the meaning of the term, arising from its etymology and various use. The word æsthetic, in its original Greek form, means anything that has to do with perception by the senses. The limitation of the term to the comparatively narrow class of sensations and perceptions occupied with the Beautiful and its allied properties is due to the Germans, and primarily to Baumgarten, who started from the supposition that, just as truth is the end and perfection of pure knowledge or the understanding, and good that of the will, so beauty must be the supreme aim of all sensuous knowledge.

A very brief survey of what has been written under the name æsthetics is sufficient to show that it includes, as its first and foremost problem, the determination of the nature and laws of Beauty, including along with the Beautiful, in its narrower signification, its kindred subjects, the Sublime and the Ludicrous. To discover what it is in things which makes them beautiful or ugly, sublime or ludicrous, is one constant factor in the æsthetic problem.

Metaphysical speculation in æsthetics centres about the objective nature of beauty, and arises somewhat in the following manner:—The appreciation of the Beautiful is a mode of perception. In estimating a beautiful landscape or a beautiful statue, the mind perceives the beauty as a property of the object.

In the scientific discussion of æsthetic subjects, the antithesis of subject and object in human cognition is accepted as a phenomenal distinction, without any inquiry into its ontological meaning. Inquirers no longer discuss the essence of beauty, looked on as a transcendental

conception above all experience, but seek to determine in what the Beautiful, as a series of phenomena, clearly and visibly consists.

Greek Speculations.—Ancient Greece supplies us with the first speculations on the Beautiful and the aims of the fine arts. Nor is it surprising that among a people so productive of noble artistic creations, and at the same time so speculative, numerous attempts to theorize on these subjects should have been made. We have in classic writings many allusions to works of an æsthetic character now lost, such as a series on poetry, harmony, and even painting, by Democritus. It is to be gathered, too, from Plato's Dialogues that the Sophists made the principles of beauty a special department in their teaching. The first Greek thinker, however, whose views on these subjects are at all known, is Socrates. Accepting Xenophon's account of his views in the *Memorabilia* and the *Symposium*, we find that he regarded the Beautiful as coincident with the Good, and both of them as resolvable into the Useful. Every beautiful object is so called because it serves some rational end, whether the security or gratification of man.

Of the precise views of Plato on this subject, even if they were really formed, it is very difficult to gain a just conception from the Dialogues. At the same time we may conclude that Plato's mind leaned decidedly to a theory of an absolute beauty.

In the *Symposium* he describes how love (Eros) produces aspiration towards the pure idea of beauty. It is only this absolute beauty, he tells us, which deserves the name of beauty; and this is beautiful in every manner, and the ground of beauty in all things.

Omitting to notice the few valuable remarks on æsthetic subjects of the later Greeks and their Roman contemporaries, one may briefly refer to the views of the Alexandrian mystic and Neo-Platonist Plotinus. His theory is found in an essay on the Beautiful in the series of discourses called *Enneades*. As to the characteristic form of beauty, he supposed, in opposition to Aristotle, that a single thing not divisible into parts might be beautiful through its unity and simplicity. He attached special worth to the beauty of colors in which material darkness is overpowered by light and warmth.

After Plotinus there is little speculation on æsthetic subjects till we come to modern writers. St. Augustine wrote a treatise on the Beautiful, now lost, in which he appears to have reproduced Platonic ideas under a Christian guise. He taught that unity is the form of all beauty. Infinite goodness, truth, and beauty are the attributes of the Deity, and communicated by him to things. Of the modern theories, the German systems are the most metaphysical, and have most affinity with ancient speculation. In German literature the two divisions of metaphysical deduction and critical construction of æsthetic principles are very sharply contrasted, and nearly every writer on the subject is easily referred to one or other of the classes. On the one hand, we have the laborious systematic philosophers, as Kant and Hegel; and on the other, men who entered upon æsthetic speculation either as connoisseurs of some special department, as Winckelmann and Lessing, or even as productive artists—for example, Schiller and Goethe.

German Writers.—The first of the Germans who attempted to fit a theory of the Beautiful and of Art into a complete system of philosophy was Baumgarten.

The next original philosophical scheme of æsthetics is that of Kant. His system of knowledge falls into three branches—the critique of pure reason, which has to determine what are the *a priori* elements in the knowledge of objects; the critique of practical reason, which inquires into the *a priori* determinations of the will; and the critique of judgment, which he regards as

a connecting link between the other two, and which has to do with any *a priori* principles of emotion (pleasure and pain), as the middle term between cognition and volition.

After Kant, the next philosopher to discuss the metaphysics of the Beautiful and Art is Schelling. He sought to engraft art upon his curious system of transcendental idealism.

Passing over Solger, whose æsthetic doctrine is little more than a revival of Platonism, we come to Hegel. His system of philosophy falls into three parts, all based on the self-movement of the idea or absolute: (1.) The logic discussing the pure universal notions which are the logical evolution of the absolute, as pure thought; (2.) Philosophy of nature — the disruption of thought, the idea, into the particular and external; (3.) Philosophy of the spirit — the return of thought or the absolute from this self-alienation to itself in self-cognizant thought.

Lessing is the first modern who has sought to deduce the special function of an art from a consideration of the means at its disposal. In his *Laokoon* he defines the boundaries of poetry and painting in a manner which has scarcely been improved on since. In slight divergence from Winckelmann, who had said that the representation of crying was excluded from sculpture by the ancients as unworthy of a great soul, Lessing sought to prove that it was prohibited by reason of its incompatibility with the conditions of plastic beauty. He reasoned from the example of the celebrated group, the *Laokoon*. Visible beauty was, he said, the first law of ancient sculpture and painting.

Goethe wrote several tracts on æsthetic topics, as well as many aphorisms. He attempts to mediate between the claims of ideal beauty, as taught by Winckelmann, and the aims of individualisation. Schiller discusses, in a number of disconnected essays and letters, some of the principal questions in the philosophy of art. He looks at art as a side of culture and the forces of human nature, and finds in an æsthetically cultivated soul the reconciliation of the sensual and rational. Other writers of this class, as Wilhelm von Humboldt, the two Schlegels, Gervinus, though they have helped to form juster views of the several kinds of poetry, &c., have contributed little to the general theory of art.

French writers on Æsthetics.— In passing from German to French writers on æsthetic topics we find, as might be expected, much less of metaphysical assumption and a clearer perception of the scientific character of the problem. At the same time, the authors are but few, and their works mostly of a fragmentary character. Passing by the Jesuit André, who sought to rehabilitate Augustin's theory of the Beautiful, we first light on the name of Batteux. He seeks to determine the aims of art by elucidating the meaning and value of the imitation of nature. He classifies the arts according to the forms of space and time, those of either division being capable of combining among themselves, but not with those of the other. Thus architecture, sculpture, and painting may co-operate in one visible effect; also music, poetry, and the dance. Diderot, in the *Encyclopædia*, sought to define beauty by making it to consist in the perception of relations, naturalness, or fidelity to nature. Père Buffier said it is the type of a species which gives the measure of beauty. A beautiful face, though rare, is nevertheless the model after which the largest number is formed.

The lectures of Cousin, entitled *Du Vrai, du Beau, et du Bien*, the *Cours d'Esthétique* of Jouffroy, and the systematic treatise of Lévêque, *La Science du Beau*, are the principal works of this school. The last, as the most elaborate, will afford the student the best insight into this mode of speculation.

Italian and Dutch Writers.— There are few writers on æsthetic subjects to be found in Italian and Dutch literature, but they have little of original speculation. The Italian, as Pagano and Muratori, follow French and English writers. One Dutch writer, Franz Hemsterhuis (18th century), is worth naming. His philosophic views are an attempt at reconciliation between the sensational and the intuitive system of knowledge. The only faculty of true knowledge is an internal sense, nevertheless all true knowledge comes *through* the senses. The soul, desiring immediate and complete knowledge, and being limited by its union with the senses, which are incapable of perfectly simultaneous action, strives to gain the greatest number of the elements of cognition or ideas in the shortest possible time. In proportion as this effort is successful, the knowledge is attended with enjoyment. The highest measure of this delight is given by beauty, wherefore it may be defined as that which affords the largest number of ideas in the shortest time.

English Writers.— In the æsthetic speculations of English writers, we find still less of metaphysical construction and systematisation than in those of French thinkers. Indeed, it may be said that there is nothing answering to the German conception of æsthetic in our literature. The inquiries of English and Scotch thinkers have been directed for the most part to very definite and strictly scientific problems, such as the psychological processes in the perception of the Beautiful. The more moderate metaphysical impulses of our countrymen have never reached beyond the bare assertion of an objective and independent beauty. Hence we find that the German historians regard these special and limited discussions as so many empirical reflections, wholly devoid of the rational element in true philosophy. English writers are easily divisible into two groups — (1.) Those who lean to the conception of a primitive object beauty, not resolvable into any simpler ingredients of sensation or simple emotion, which is perceived intuitively either by reason or by some special faculty, an internal sense; (2.) Those who, tracing the genesis of beauty to the union of simple impressions, have been chiefly concerned with a psychological discussion of the origin and growth of our æsthetic perceptions and emotions.

Lord Shaftesbury is the first of intuitive writers on beauty. His views are highly metaphysical and Platonic in character. The Beautiful and the Good are combined in one ideal conception, much as with Plato. Matter in itself is ugly. The order of the world, wherein all beauty really resides, is a spiritual principle, all motion and life being the product of spirit. The principle of beauty is perceived not with the outer senses, but with an eternal — that is, the moral — sense. This perception affords the only true delight, namely, spiritual enjoyment. Shaftesbury distinguishes three grades of the Beautiful, namely, (1.) Inanimate objects, including works of art; (2.) Living forms, which reveal the spiritual formative force; and (3.) The source from which these forms spring, God.

Hutcheson follows many of Shaftesbury's ideas. Yet he distinctly disclaims any independent self-existing beauty in objects apart from percipient minds. "All beauty," he says, "is relative to the sense of some mind perceiving it."

The next writer of consequence on the intuitive is Reid. He held, on the ground of common sense, that beauty must exist in objects independently of our minds. As to the nature of the Beautiful, he taught that all beauty resides primarily in the faculties of the mind, intellectual and moral. The beauty which is spread over the face of visible nature, is an emanation from this

spiritual beauty, and is beautiful because it symbolizes and expresses it. Thus the beauty of a plant resides in its perfection for its end.

He recognises three forms of Sublimity: those of Extension or space, of Protension or time, and of Intension or power. Finally, he thinks that the Picturesque differs from the Beautiful in appealing simply to the imagination. A picturesque object is one whose parts are so palpably unconnected that the understanding is not stimulated to the perception of unity.

A very like interpretation of beauty, as spiritual and typical of divine attributes, has been given by Mr. Ruskin in the second volume of his *Modern Painters*. This part of his work, bearing the title "Of Ideas of Beauty," has a very systematic appearance, but is in fact a singularly desultory series of æsthetic ideas put into a very charming language, and colored by strong emotion. The forms of typical beauty are—(1.) Infinity, the type of the divine incomprehensibility; (2.) Unity, the type of the divine comprehensiveness; (3.) Repose, the type of the divine permanence; (4.) Symmetry, the type of the divine justice; (5.) Purity, the type of the divine energy; and (6.) Moderation the type, of government by law.

Of the more analytic writers on the effects of the Beautiful, Addison deserves a passing mention. His *Essays on the Imagination*, contributed to the *Spectator*, are admirable specimens of popular æsthetic reflection. Addison means by the pleasures of imagination those which arise originally from sight, and he divides them into two classes—(1.) Primary pleasure, which entirely proceeds from objects before our eyes; and (2.) Secondary pleasures, flowing from ideas of visible objects. The original sources of pleasure in visible objects are greatness, novelty, and beauty. The secondary pleasures, he rightly remarks, are rendered far more extended than the original by the addition of the proper enjoyment of resemblance, which is at the basis of all mimicry and wit.

In the *Elements of Criticism* of Lord Kaimes, another attempt is made to affiliate æsthetic phenomena to simpler pleasures of experience. Beauty and ugliness are simply the pleasant and the unpleasant in the higher senses of sight and hearing. He illustrates the English tendency to connect mental processes with physiological conditions, by referring the main elements of the feeling of sublimity to the effect of height in objects in compelling the spectator to stand on tiptoe, by which the chest is expanded and muscular movements produced which give rise to the peculiar emotion.

Passing by the name of Sir Joshua Reynolds, whose theory of beauty closely resembles that of Père Buffier, we come to the speculations of another artist and painter, Hogarth. He discusses in his *Analysis of Beauty* all the elements of visible beauty, both form and color, often manifesting great speculative skill, and always showing a wide and accurate knowledge of art. He finds, altogether, six elements in beauty, namely—(1.) Fitness of the parts to some design, as of the limbs for support and movement; (2.) Variety in as many ways as possible, thus in form, length, and direction of line, shape, and magnitude of figure, &c.; (3.) Uniformity, regularity, or symmetry, which is only beautiful when it helps to preserve the character of fitness; (4.) Simplicity or distinctness, which gives pleasure not in itself, but through its enabling the eye to enjoy variety with ease; (5.) Intricacy, which provides employment for our active energies, ever eager for pursuit, and leads the eye "a wanton kind of chase"; (6.) Quantity or magnitude, which draws our attention, and produces admiration and awe. The beauty of proportion he very acutely resolves into the needs of fitness. Hogarth applies these principles

to the determination of degrees of beauty in lines, and figures, and compositions of forms. Among lines he singles out for special honor the serpentine (formed by drawing a line once round from the base to the apex of a long, slender cone) as the line of grace or beauty *par excellence*. Its superiority he places in its many varieties of direction or curvature, though he adds that more suddenly curving lines displease by their grossness, while straighter lines appear lean and poor. In this last remark Hogarth tacitly allows another principle in graceful line, namely, gentleness, as opposed to suddenness, of change in direction.

Burke's speculations on the Beautiful, in his *Philosophical Inquiry into the Origin of our Ideas of the Sublime and Beautiful*, are curious as introducing physiological considerations into the explanation of the feelings of beauty they illustrate, moreover, the tendency of English writers to treat the problem as a physiological one. He finds the elements of beauty to be—(1.) Smallness of size; (2.) Smoothness of surface; (3.) Gradual variation of direction of outline, by which he means gentle curves; (4.) Delicacy, or the appearance of fragility; (5.) Brightness, purity, and softness of color.

Alison, in his well-known *Essays on the Nature and Principles of Taste*, proceeds on an exactly opposite method to that of Hogarth and Burke. He considers and seeks to analyse the mental process which goes on when we experience the emotion of beauty or sublimity. He finds that this consists in a peculiar operation of the imagination, namely, the flow of a train of ideas through the mind, which ideas are not arbitrarily determined, but always correspond to some simple affection or emotion (as cheerfulness, sadness, awe), awakened by the object.

Jeffrey's *Essays on Beauty* is little more than a modification of Alison's views.

D. Stewart's chief merit in the æsthetic discussions, contained in his *Philosophical Essays*, consists in pointing out this unwarranted assumption of some single quality (other than that of producing a certain refined pleasure) running through all beautiful objects, and constituting the essence of beauty.

Of the association psychologists James Mill did little more towards the analysis of the sentiments of beauty than re-state Alison's doctrine. On the other hand, Professor Bain, in his treatise *The Emotions and the Will*, carries this examination considerably further. He asserts with Stewart that no one generalisation will comprehend all varieties of beautiful objects. He thinks, however, that the æsthetic emotions, those involved in the fine arts, may be roughly circumscribed and marked off from other modes of enjoyment by means of three characteristics—(1.) Their not serving to keep up existence, but being gratifications sought for themselves only; (2.) Their purity from all repulsive ingredients; (3.) Their eminently sympathetic or sharable nature in contrast to the exclusive pleasures of the individual in eating, &c.

An interesting turn has been given to the psychology of æsthetics by Mr. Herbert Spencer. In some of his essays, as the one entitled "The Origin and Function of Music," and more fully in the concluding chapter of his *Psychology* (second edition), on the *Æsthetic Sentiments*, he offers a new theory of the genesis of the pleasures of beauty and art, based on his doctrine of evolution. He takes up Schiller's idea of the connection between æsthetic activity and play, only he deals with this latter not as an ideal tendency, but as a phenomenal reality, seeking to make it the actual starting-point in the order of evolution of æsthetic action. Play or sport is defined as the superfluous and useless exercise of faculties that have been quiescent for a time, and have in this way become so ready to discharge as to relieve themselves by

simulated actions. *Æsthetic* activities yield to the higher powers of perception and emotion the substituted exercise which play yields to the lower impulses, agreeing with play in not directly subserving any process conducive to life, but being gratifications sought for themselves only. This point of affinity between the two classes of pleasure is a valuable addition to *æsthetic* theory, and helps one to understand how the artistic impulse first arose. Oscar Wilde, who a few years ago created a *furor* in the United States by his lectures on *Æsthetics*, is the most noted exponent of the subject at the present day.

ÆTION, whose picture of the marriage of Roxana and Alexander was exhibited at the Olympic games, flourished in the times of Hadrian and the Antonines.

ÆTIUS, a Roman general of the closing period of the western empire, born at Dorostolus in *Mœsia*, late in the 4th century. While detained for some time as a hostage in the camp of *Rhuas*, king of the Huns, he acquired an influence with the barbarians that was afterwards of much advantage to himself. He led into Italy an army of 60,000 Huns. In Gaul he won his military reputation, upholding for nearly twenty years, by combined policy and daring, the falling fortunes of the western empire. His greatest victory was that of *Chalon-sur-Marne* (20th Sept. 451), in which he utterly routed *Attila* and the Huns—the number slain on both sides being, according to one computation, 300,000, though this is obviously an exaggeration. This was the last triumph of the empire. Three years later (454) *Ætius* presented himself at court to claim the emperor's daughter in marriage for his son *Gaudentius*; but *Valentinian*, suspecting him of designs upon the crown, slew him with his own hand.

ÆTIUS, surnamed "the Atheist," founder of an extreme sect of the Arians, was a native of *Cœle-Syria*. In 356 he went to *Alexandria* with *Eunomius* in order to advocate Arianism, but he was banished by *Constantius*. *Julian* the apostate recalled him from exile, bestowed upon him an estate in *Lesbos*, and retained him for a time at his court in *Constantinople*. Being consecrated a bishop, he used his office in the interests of Arianism by creating other bishops of that party. At the accession of *Valens* (364) he retired to his estate at *Lesbos*, but soon returned to *Constantinople*. He died in 367.

ÆTIUS, a Greek physician, born at *Amida* in *Mesopotamia*, who lived at the end of the 5th or the beginning of the 6th century. He studied at *Alexandria*, and was physician to the court at *Constantinople*.

ÆTNA. See *ETNA*.

ÆTOLIA, a country of ancient Greece. The country is in general mountainous and woody, but along the coast from the *Achelous* to the *Evenus*, and northward to *Mount Aracynthus*, is a plain of great fertility. The *Ætoli*ans were a restless and turbulent people, strangers to friendship or principles of honor, and they were consequently regarded by the other states of Greece as outlaws and public robbers. On the other hand, they were bold and enterprising in war, undaunted in the greatest dangers, and jealous defenders of their liberties. They distinguished themselves above all the other nations of Greece in opposing the ambitious designs of the *Macedonian* princes, who, after having reduced most of the other states, were forced to grant them a peace upon very honorable terms. Social war was kindled by the *Ætoli*ans with the express purpose of humbling the *Achæans*. In the latter they held out for the space of three years against united forces, but were obliged at last to purchase a peace by yielding up to *Philip* all *Acarnania*. In order to regain this province they entered into an alliance with *Rome* against *Philip*, and proved of great service to the Romans in their war with

him; but, being dissatisfied with the terms of peace granted by *Flaminius*, they made war upon the Romans themselves. They were speedily overcome, and only obtained peace on very humiliating terms. After the conquest of *Macedon* by *Æmilius Paullus* the *Ætoli*ans were reduced to a much worse condition; for not only those among them who had openly declared for *Perseus*, but those who were only suspected to have secretly favored him, were sent to *Rome* to clear themselves before the senate. There they were detained, and never afterwards permitted to return to their native country. Five hundred and fifty of the chief men were barbarously assassinated by the partisans of *Rome* solely on the suspicion of favoring the designs of *Perseus*. The *Ætoli*ans appeared before *Æmilius Paullus* in mourning habits, and made loud complaints of such inhuman treatment, but could obtain no redress; on the contrary, ten commissioners, who had been sent by the senate to settle the affairs of Greece, enacted a decree, declaring that those who were killed had suffered justly, since it appeared to them that they had favored the *Macedonian* party. From this time those only were raised to the chief honors and employments in the *Ætolian* republic who were known to prefer the interest of *Rome* to that of their country. It is now included in the kingdom of Greece.

AFANASIEF, **ALEKSANDR NIKOLAEVICH**, a Russian scholar, distinguished for his researches in Slavonic literature and archæology, was born in 1825 and died in 1871.

AFER, **DOMITIUS**, orator, born at *Nismes*, flourished under *Tiberius* and the three succeeding emperors. He disgraced his talents by acting as public accuser in behalf of the emperors against some of the most distinguished personages in *Rome*. Afer died in the reign of *Nero*, A.D. 60.

AFFIDAVIT means a solemn assurance of a matter of fact known to the person who states it, and attested as his statement by some person in authority. Evidence is chiefly taken by means of affidavits in the Courts of Chancery in this and other countries. The term is generally applied to a statement certified by a justice of peace or other magistrate. Affidavits are sometimes necessary as certificates that certain formalities have been duly and legally performed. They are extensively used in the practice of bankruptcy, and in the administration of the revenue. If any persons called as witnesses, or required or desiring to make an affidavit or deposition, and shall refuse or be unwilling from alleged conscientious motives to be sworn, the court or justice may, on being satisfied of the sincerity of such objections, allow such person to make a solemn affirmation or declaration. Justices are permitted to take affidavits in any matter by declaration, and a person making a false affidavit in this way is liable to punishment. Affidavits may be made abroad before any ambassador, envoy, minister, *chargé d'affaires*, secretary of embassy or legation, consul, or consular agent.

AFFINITY, in *Law*, as distinguished from consanguinity, is applied to the relation which each party to a marriage, husband and wife, bears to the kindred of the other. A man may contract a marriage with his wife's sister so as to be valid in one State of the Union, by celebrating his marriage with her in another State where such marriages are lawful—See **MARRIAGE**, **LAW OF**.

AFFINITY, **CHEMICAL**, the property or relation in virtue of which dissimilar substances are capable of entering into chemical combination with each other. Substances that are so related combine always in fixed and definite proportions; the resulting compound differs from its components in its physical properties, with the exception that its weight is exactly the sum of their weights; and the combination is always accompanied

with the evolution of heat. In these respects it differs from a mere mechanical mixture; in the latter there is contact without combination, and its properties are a mean or average of those of the substances that compose it. That effect may be given to chemical affinity, the substances must be placed in contact; but mere contact is often insufficient, and combination only takes place on the application of heat, light, electric agency, &c., or through the interposition of some foreign substance. Generally speaking, the affinity is less between substances that closely resemble each other than between those whose properties are altogether dissimilar.

AFFIRMATION. See **AFFIDAVIT**.

AFFRE, DENIS AUGUSTE, Archbishop of Paris, was born at St. Rome, in the department of Tarn, on the 27th Sept. 1793. When fourteen years of age, he became a student at the seminary of St. Sulpice. He was ordained a priest in 1818. After filling a number of ecclesiastical offices, he was elevated to the Archbishopric of Paris in 1840. During the insurrection of 1848 the archbishop was led to believe that by his personal interference peace might be restored between the soldiery and the insurgents. He accordingly applied to General Cavaignac, who warned him of the risk he incurred. Soon afterwards, the firing having ceased at his request, he appeared on the barricade at the entrance to the Faubourg St. Antoine, bearing a green branch as a sign of peace. His reception was not very favorable, and he had spoken only a few words, when the insurgents, fancying they were betrayed, opened fire upon the national guard, and the archbishop fell. He was removed to his palace, where he died on the 27th June 1848. The archbishop wrote several treatises of considerable value, including one on Egyptian hieroglyphics.

AFGHÂNISTÂN.—This is the name applied, originally in Persian, to that mountainous region between N.W. India and Eastern Persia, of which the Afghans are the most numerous and the predominant inhabitants. Afghans, under that and other names, have played no small part in Asiatic history. But the present extensive application of the name *Afghânistân* is scarcely older than the shortlived empire founded by Ahmed Khan in the middle of last century. The Afghans themselves are not in the habit of using the term.

In treating of this country, we include a part of the Hazâra mountain region, but not that part of the Oxus basin which is now under Afghan rule, for which see **AFGHAN TURKESTAN**.

Afghanistan generally may be regarded as a great quadrilateral plateau—using that term in the technical sense of a region whose lowest tracts even are considerably elevated above the sea-level—extending from about 62° to 70° E. long., and from 30° to 35° N. lat. This territory corresponds fairly to the aggregate of the ancient provinces of *Aria* (Herât), *Drangiana* (Seistan), the region of the *Paropamisada* (Kâbul), and *Arachosia* (Kandahâr), with *Gandariitis* (Peshâwar and Yûzûfzai). Though the last territory belongs ethnically to Afghanistan, an important part of it now forms the British district of Peshâwar, whilst the remainder acknowledges no master.

The boundaries of Afghanistan can be stated here only roughly; and, from the area thus broadly defined, many portions will have to be deducted as occupied by independent or semi-independent tribes. But, so understood, they may be thus stated:—

On the north: beginning from east, the great range of Hindu Kush, a western offshoot of the Himâlâya, parting the Oxus basin from the Afghan basins of the Kabul river and Helmand. From long. 68° this boundary continues westward in the prolongation of Hindu Kush, called Koh-i-Bâbâ. This breaks into several

almost parallel branches, enclosing the valleys of the river of Herat and the Murghâb or river of Merv. The half-independent Hazara tribes stretch across these branches and down into the Oxus basin, so that it is difficult here to assign a boundary. We assume it to continue along the range called Safed Koh or "White Mountain," which parts the Herat river valley from the Murghab.¹

On the east: the eastern base of the spurs of the Sulimâni and other mountains which limit the plains on the west bank of Indus, and the lower valleys opening into these, which plains (the "Derajât") and lower valleys belong to British India. North of Peshâwar district the boundary will be, for a space, the Indus, and then the limit, lying in an unknown country, between the Afghan and Dard tribes.

On the south: the eastern part of the boundary, occupied by practically independent tribes, Afghan and Bilûch, is hard to define, having no marked natural indication. But from the Shâl territory (long. 67°) belonging to the Bilûch state of KELAT, westward, the southern limits of the valleys of the Lora river, and then of the Helmand, as far as the Lake of Seistan in lat. 30°, will complete the southern boundary. Thus the whole breadth of Bilûchistân, the ancient *Gedrosia*, a dry region occupying 5° of latitude, intervenes between Afghanistan and the sea.

The western boundary runs from the intersection of the Lake of Seistan with lat. 30°, bending eastward, so as to exclude a part of the plain of Seistan on the eastern bank of the lake, and then crosses the lake to near the meridian of 61°. Thence it runs nearly due north, near this meridian, to a point on the Hari-Rûd, or river of Herat, about 70 miles below that city, where it encounters the spurs of the Safed Koh, which has been given as the northern boundary.

But if we take the limits of the entire Afghan *dominions*, as they at present exist, the western boundary will continue north along the Hari-Rûd to lat. 36°, and the northern boundary will run from this point along the borders of the Turkman desert, so as to include Andkhoi, to Khoja Sâleh ferry on the Oxus. The Oxus, to its source in Great Pamir, forms the rest of the northern boundary. These enlarged limits would embrace the remainder of the Hazara mountain tracts and the whole of what is now called **AFGHAN TURKESTAN**, as well as **BADAKHSHAN** with its dependencies, now tributary to the Afghan Amir.

The extreme dimensions of Afghanistan, as at first defined, will be about 600 miles from east to west, and 450 miles from north to south; and, if we take the whole Afghan dominion, the extent from north to south will be increased to 600 miles. Within both the areas so defined, however, we have included some territory over which the Afghan government has no control whatever, and much over which its authority is respected only when backed by a special exertion of force. Under the former head come the valleys of the Yusufzai clan north of Peshâwar, the Momands Afridis, Vaziris, &c., adjoining that district on the west and south-west, the high-lying valleys of Chitrâl or Kâshkâr, and of the independent Pagans or Kâfirs, among the loftier spurs of Hindu Kush. Under the latter head come the eastern district and (partially) of Kurram, the Kâkar country in the extreme south-east, much of the country of the tribes called Eimâk and Hazara in the north-west, and probably Badakhshân with its dependencies.

If we suppose the sea to rise 4000 feet above its existing level, no part of the quadrilateral plateau that we

¹ Not to be confounded with the more easterly *Safed Koh* of the Kabul basin.

have defined would be covered, except portions of the lower valley of the Kabul River, small tracts toward the Indus, and a triangle, of which the apex should be at the Lake of Seistan in the extreme south-west, and the base should just include Herat and Kandahar, passing beyond those cities to intersect the western and southern boundaries, respectively. Isolated points and ridges within this triangle would emerge.

NATURAL DIVISIONS.—Of these, this Kabul basin (1.) forms the first. As others we may discriminate—(2.) The lofty central part of the table-land on which stand Ghazni and Kala't-i-Ghilzai, embracing the upper valleys of ancient *Arachosia*; (3.) The upper Helmand basin; (4.) The lower Helmand basin, embracing Girishk, Kandahar, and the Afghan portion of Seistan; (5.) The basin of the Herat river; and (6.) The eastern part of the table-land, draining by streams, chiefly occasional torrents, towards the Indus.

Kabul Basin.—Its northern limit is the range of Hindu Kush, a name which properly applies to the lofty, snow-clad crest due north of Kabul, and perhaps especially to one pass and peak.

The Kabul river (the ancient *Kophes*) is the most important river of Afghanistan. It may be considered as fully formed about 30 miles east of Kabul, by the junction thereof (the confluence does not seem to have been fixed by any traveller) of the following streams:—(a.) The *Kabul* stream, rising in the Unai pass towards the Helmand, which, after passing through the city, has been joined by the Logar river flowing north from the skirts of the Ghilzai plateau; (b.) A river bringing down from the valleys Ghorband, Parwān, and Panjshir, a large part of the drainage of Hindu Kush, and watering the fruitful plain of Dâman-i-Koh (the "Hill-skirt"), intersected by innumerable brooks, and studded with vineyards, gardens, and fortalices. This river was formerly called Bârân, a name apparently obsolete, but desirable to maintain; (c.) The river *Tagao*, coming down from the spurs of Hindu Kush on the Kafir borders.

Some 30 miles further east, the *Alishang* enters on the left bank from Laghmān, above which this river and its confluent drain western KAFIRISTAN. Twenty miles further, and not far beyond Jalālābād, the Kabul river receives from the same side a confluent entitled, as regards length, to count as the main stream. In some older maps this bears the name of Kâma, from a place near the confluence, and in more recent ones *Küner*, from a district on its lower course. Higher it is called the *river of Kashkar*, and the *Beilam*. It seems to be the *Chaoşpes*, and perhaps the *Malamantus* of the ancients. It rises in a small lake near the borders of Pamir, and flows in a south-west direction through the length of Kashkar or Chitral, an independent valley-state, whose soil lies at a height of 6000 to 11,000 feet. The whole length of the river to its confluence with the Kabul river cannot be less than 250 miles, *i.e.*, about 80 miles longer than that regarded as the main stream, measured to its most remote source.

The basin of the Kabul river is enclosed at the head by the Paghman range, an offshoot of Hindu Kush, which divides the Kabul valleys from the Helmand. Generally the characteristics of this country are elevated plateaux of sandy or gravelly surface, broken by ranges of rocky hills, and often expanding in wide spaces of arid waste, which terminate to the south-west in a regular desert of shifting sand. Even in cultivated parts there is a singular absence of trees, and when the crops are not visible this imparts an aspect of great desolation and emptiness to the landscape. Natural wood, however, is found in some parts of West Afghanistan, as in the almost tropical delta of the Helmand, in the

Ghûr territory, and on the Herat river below Herat. Generally, indeed, in such cases the trees appear to be mimosas, tamarisks, and the like, with little body of foliage.

Next to the Kabul river in importance, and probably much exceeding it in volume as it certainly does in length, is the *Helmand* (*Etymander*), the only considerable river in its latitude from the Tigris to the Indus.

As we know nothing of the lake in which the Lora is said to end, and the greater part of the lake of SEISTAN (see that article) is excluded from Afghanistan, there remains only the *Ab-i-Istada*, on the Ghilzai plateau. This is about 65 miles S.S.W. of Ghazni, and stands at a height of about 7000 feet, in a site of most barren and dreary aspect, with no tree or blade of grass, and hardly a habitation in sight. It is about 44 miles in circuit, and very shallow; not more than 12 feet deep in the middle. The chief feeder is the Ghazni river. The Afghans speak of a stream draining the lake, but this seems to be unfounded, and the saltiness and bitterness of the lake is against it. Fish entering the salt water from the Ghazni river sicken and die.

The chief political divisions of Afghanistan in recent times are stated to be Kabul, Jalalabad, Ghazni, Kandahar, Herat, and AFGHAN TURKESTAN (*q.v.*), to which are sometimes added the command of the Ghilzais and of the Hazaras. This list seems to omit the unruly districts of the eastern table-land, such as Kurrum, Khost, &c.

In addition to KABUL, GHAZNI, KANDAHAR, HERAT, described under those articles, there are not many places in Afghanistan to be called towns. We notice the following:—

Jalālābād lies, at a height of 1946 feet, in a plain on the south of the Kabul river. It is by road 100 miles from Kabul, and 91 from Peshawar. Between it and Peshawar intervene the Khybar and other adjoining passes; between it and Kabul the passes of Jagdalak, Khurd-Kabul, &c. Akbar built Jalalabad. Hindus form a considerable part of the town population, and have a large temple.

Istālif is a town in the Koh Daman, 20 miles N.N.W. of Kabul, which was stormed and destroyed, 29th September, 1842, by a force under General M'Caskill, to punish the townspeople for the massacre of the garrison at Charikar, and for harboring the murderers of Burnes. The place is singularly picturesque and beautiful. The town is estimated, with seven villages depending on it, to contain about 18,000 souls.

Chārīkār (population 5000) lies about 20 miles north of Istālif, at the north end of Koh Daman, and watered by a canal from the Ghorband branch of the Baran river.

Kala't-i-Ghilzai has no town, but is a fortress of some importance on the right bank of the Tarnak, on the road between Ghazni and Kandahar, 89 miles from the latter, and at a height of 5773 feet.

Girishk is also a fort rather than a town, the latter being insignificant. It is important for its position on the high road between Kandahar and Herat, commanding the ordinary passage and summer ford of the Helmand.

Farrah belongs to the Seistan basin, and stands on the river that bears its name, and on one of the main routes from Heras to Kandahar, 164 miles from the former, 236 miles from the latter. The population came back to the southern site after the destruction of the mediæval city by Shah Abbas, and the city prospered again till its bloody siege by Nadir Shah. Since then, under constant attacks, it has declined, and in 1837 the remaining population, amounting to 6000, was

carried off to Kandahar. Such are the vicissitudes of a city on this unhappy frontier.

Sabzvár, the name of which is a corruption of old Persian, *Isphiazar*, "horse-pastures," is another important strategic point, 93 miles from Herat and 71 miles north of Farrah, in the gradual decay to the latter.

Zarni is a town in the famous but little known country of Ghur, to the east of Herat, the cradle of a monarchy (the Ghurid dynasty) which supplanted the Ghaznavides, and ruled over an extensive dominion, including all Afghanistan, for several generations.

The variety of climate is immense, as might be expected. At Kabul, and over all the northern part of the country to the descent at Gandamak, winter is rigorous, but especially so on the high Arachosian plateau. In Kabul the snow lies for two or three months; the people seldom leave their houses, and sleep close to stoves. At Ghazni the snow has been known to lie long beyond the vernal equinox; the thermometer sinks to 10° and 15° below zero (Fahr.); and tradition relates the entire destruction of the population of Ghazni by snow-storms more than once.

Afghanistan is believed to be rich in minerals, but few are wrought. Some small quantity of gold is taken from the streams in Laghman and the adjoining districts. Famous silver mines were formerly wrought near the head of the Panjshir valley, in Hindu Kush. Iron of excellent quality is produced in the (independent) territory of Bajaur, north-west of Peshawar, from magnetic iron sand, and is exported. Iron ore is most abundant near the passes leading to Bamian, and in other parts of Hindu Kush. Copper ore from various parts of Afghanistan has been seen, but is nowhere worked.

Lead is found, e.g., in Upper Bangash (Kurram district), and in the Shinwari country (also among the branches of Safed Koh), and in the Kakar country. There are reported to be rich lead mines near Herat scarcely worked. Lead, with antimony, is found near the Arghand-ab, 32 miles north-west of Kalat-i-Ghilzai; in the Wardak hills, 24 miles north of Ghazni; in the Ghorband valley, north of Kabul; and in the Afridi country, near our frontier. Most of the lead used, however, comes from the Hazara country, where the ore is described as being gathered on the surface. An ancient mine of great extent and elaborate character exists at Feringal, in the Ghorband valley. Antimony is obtained in considerable quantities at Shah-Maksud, about 30 miles north of Kandahar.

Silicate of zinc in nodular fragments comes from the Zhub district of the Kakar country.

Sulphur is said to be found at Herat, dug from the soil in small fragments, but the chief supply comes from the Hazara country, and from Pirkisri, on the confines of Seistan, where there would seem to be a crater, or fumarole. Sal-ammoniac is brought from the same place. Gypsum is found in large quantities in the plain of Kandahar, being dug out in fragile coralline masses from near the surface.

Coal (perhaps lignite) is said to be found in Zurnat (between the Upper Kurram and the Gomal) and near Ghazni.

Nitre abounds in the soil over all the south-west of Afghanistan, and often affects the water of the *karez*, or subterranean canals.

In most parts of the country there are two harvests, as generally in India. One of these, called by the Afghans *baharak*, or the spring crop, is sown in the end of autumn, and reaped in summer. It consists of wheat, barley, and a variety of lentils. The other, called *paizah* or *tirmái*, the autumnal, is sown in the end of spring, and reaped in autumn. It consists of rice, varieties of millet and sorghum, of maize, *Phaseolus Mungo*, tobacco,

beet, turnips, &c. The loftier regions have but one harvest.

Wheat is the staple food over the greater part of the country. Rice is largely distributed, but is most abundant in Swat (independent), and best in Peshawar (British). It is also the chief crop in Kurram. In much of the eastern mountainous country *bájra* (*Holcus spicatus*) is the chief grain. Most English and Indian garden-stuffs are cultivated; turnips in some places very largely, as cattle food.

The growth of melons, water-melons, and other cucurbitaceous plants is reckoned very important, especially near towns; and this crop counts for a distinct harvest.

Sugar-cane is grown only in the rich plains; and though cotton is grown in the warmer tracts, most of the cotton cloth is imported.

Madder is an important item of the spring crop in Ghazni and Kandahar districts, and generally over the west, and supplies the Indian demand. It is said to be very profitable, though it takes three years to mature. Saffron is grown and exported. The castor-oil plant is everywhere common, and furnishes most of the oil of the country. Tobacco is grown very generally; that of Kandahar has much repute, and is exported to India and Bokhara. Two crops of leaves are taken.

Lucerne and a trefoil called *shaftal* form important fodder crops in the western parts of the country, and, when irrigated, are said to afford ten or eleven cuttings in the season. The *komal* (*Prangos pabularia*) is abundant in the hill country of Ghazni, and is said to extend through the Hazara country to Herat. It is stored for winter use, and forms an excellent fodder. Others are derived from the *Holcus sorghum*, and two kinds of panick. It is common to cut down the green wheat and barley before the ear forms, for fodder, and the repetition of this, with barley at least, is said not to injure the grain crop.

Of great moment are the fruit crops. All European fruits are produced profusely, in many varieties, and of excellent quality. Fresh or preserved, they form a principal food of a large class of people, and the dry fruit is largely exported. In the valleys of Kabul, mulberries are dried, and packed in skins for winter use. This mulberry cake is often reduced to flour, and used as such, forming in some valleys the main food of the people.

Grapes are grown very extensively, and the varieties are very numerous. The vines are sometimes trained on trellises, but most frequently over ridges of earth 8 or 10 feet high. The principal part of the garden lands in villages round Kandahar is vineyard, and the produce must be enormous.

Open canals are usual in the Kabul valley, and in eastern Afghanistan generally; but over all the western parts of the country much use is made of the *karez*, which is a subterranean aqueduct uniting the waters of several springs, and conducting their combined volume to the surface at a lower level. Elphinstone had heard of such conduits 36 miles in length.

As regards vertebrate zoölogy, Afghanistan lies on the frontier of three regions, viz., the *Eurasian*, the *Ethiopian* (to which region Biluchestan seems to belong), and the *Indo-Malayan*. Hence it naturally partakes somewhat of the forms of each, but it is in the main *Eurasian*.

The camel is of a more robust and compact breed than the tall beast used in India, and is more carefully tended. The two-humped Bactrian camel is sometimes seen, but is not a native.

Horses form a staple export to India. The best of these, however, are brought from Maimana and other places on the Chorasán and Turkoman frontier. The indigenous horse is the *yábú*, a stout, heavy-shouldered

animal, of about 14 hands high, used chiefly for burden, but also for riding. It gets over incredible distances at an ambling shuffle; but is unfit for fast work, and cannot stand excessive heat.

The cows of Kandahar and Seistan give very large quantities of milk. They seem to be of the humped variety, but with the hump evanescent. Dairy produce is important in Afghan diet, especially the pressed and dried curd called *krút* (an article and name perhaps introduced by the Mongols).

There are two varieties of sheep, both having the fat tail. One bears a white fleece, the other a russet or black one. Much of the white wool is exported to Persia, and now largely to Europe by Bombay. Flocks of sheep are the main wealth of the nomad population, and mutton is the chief animal food of the nation. In autumn large numbers are slaughtered, their carcasses cut up, rubbed with salt, and dried in the sun. The same is done with beef and camel's flesh.

The goats, generally black or parti-colored, seem to be a degenerate variety of the shawl-goat.

Silk is produced in Kabul, Jalalabad, Kandahar, and Herat, and chiefly consumed in domestic manufactures, though the best qualities are carried to Panjab and Bombay.

Excellent carpets—soft, brilliant, and durable in color—are made at Herat. They are usually sold in India as Persian. Excellent felts and a variety of woven goods are made from the wool of the sheep, goat, and Bactrian camel.

Rosaries are extensively made at Kandahar from a soft crystallized silicate of magnesia (chrysolite). The best are of semi-transparent straw color, like amber. They are largely exported, especially to Mecca.

Practically, there are no navigable rivers in Afghanistan, nor does there exist any wheeled carriage. Hence goods are carried on beasts of burden, chiefly camels, along roads which often lie through close and craggy defiles, and narrow, stony valleys among bare mountains, or over waste plains. Though from time immemorial the larger part of the products of India destined for western Asia and Europe has been exported by sea, yet at one time valuable caravans of these products, with the same destination, used to traverse these rugged Afghan roads.

The chief imports by Peshawar from India into Afghanistan are cotton, woollen, and silk goods; from England, coarse country cloths, sugar and indigo, Benares brocades, gold thread and lace, scarves, leather, groceries, and drugs. The exports are raw silk and silk fabrics of Bokhara, gold and silver wire (Russian), horses, almonds and raisins, and fruits generally, furs (including dressed fox skins and sheep skins), and bullion.

Races may first be divided into Afghan and non-Afghan, of whom the Afghan people are predominant in numbers, power and character.

The Afghans themselves do not recognise as entitled to that name all to whom we give it. According to Bellev they exclude certain large tribes, who seem, nevertheless, to be essentially of the same stock, speaking the same language, observing the same customs, and possessing the same moral and physical characteristics. These are recognised as *Patháns*, but not as *Afghans*, and are all located in the vicinity of the Sulimani mountains and their offshoots towards the east.

Of the Afghans proper there are about a dozen great clans, with numerous subdivisions. Of the great clans the following are the most important:—

The *Durránis*, originally called Abdalis, received the former name from a famous clansman, Ahmed Shah.

The *Ghilzais* are the strongest of the Afghan clans, and perhaps the bravest.

The *Yusufzais* occupy an extensive tract of hills and valleys north of Peshawar, including part of the Peshawar plain.

The *Kakars*, still retaining in great measure their independence, occupy a wide extent of elevated country in the south-east of Afghanistan, among the spurs of the Toba and Sulimani mountains, bordering on the Biluch tribes.

Of the non-Afghan population associated with the Afghans, the *Tájiks* come first in importance and numbers.

The *Kizilbáshes* may be regarded as modern Persians, but more strictly they are Persianised Turks, like the present royal race and predominant class in Persia.

The *Hazaras* have their stronghold and proper home in the wild, mountainous country on the north-west of Afghanistan proper, including those western extensions of Hindu Kush.

The Hazaras generally have features of Mongol type, often to a degree that we might call exaggerated, and there can be no doubt that they are mainly descended from fragments of Mongol tribes who came from the east with the armies of Chinghiz Khan and his family, though other races may be represented among the tribes called Hazaras.

Eimák is a term for a sept or section of a tribe. It has come to be applied, much as *hazara*, to certain nomadic or semi-nomadic tribes west of the Hazaras, of whom we have been speaking, and immediately north of Herat.

Hindkis.—This is the name given to people of Hindu descent scattered over Afghanistan. They are a fine, athletic, dark, handsome race, considerable in numbers, but poor, and usually gaining a livelihood as farm-servants, barbers, sweepers, musicians, etc.

Bilúchis.—Many of these squat among the abandoned tracts on the lower Helmand; a fierce and savage people, professing Islam, but not observing its precepts, and holding the grossest superstitions; *vendetta* their most stringent law; insensible to privation, and singularly tolerant of heat; camel-like in capacity to do without drink; superior to the Afghans in daring and address, which are displayed in robber raids carried into the very heart of Persia.

There remain a variety of tribes in the hill country north of the Kabul river, speaking various languages, seemingly of *Præritic* character, and known as Kohistanis, Laghmanis, Pashais, etc.; apparently converted remnants of the aboriginal tribes of the Kabul basin, and more or less kindred to the still unconverted tribes of Kafiristan, to the Chitral people, and perhaps to the Dard tribes who lie to the north of the Afghan country on the Indus.

An able officer of the staff in India (Col. Macgregor) has lately made a diligent attempt to estimate the population of Afghanistan, which he brings to 4,901,000 souls.

The Afghans, in government and general manners, have a likeness to other Mahomedan nations; but they have also many peculiarities.

Besides their division into clans and tribes, the whole Afghan people may be divided into dwellers in tents and dwellers in houses; and this division is apparently not coincident with tribal divisions, for of several of the great clans, at least a part is nomad and a part settled. Such, *e. g.*, is the case with the Durrani and with the Ghilzai.

They are under some indefinite control by their chiefs, to whom serious disputes are referred. Petty matters are settled by the "greybeards" of the community, guided by the Afghan traditional code. Many of the nomad tribes are professed and incorrigible thieves. Among certain tribes the ceremony of naming a male

child is accompanied by the symbolical act of passing him through a hole made in the wall of a house, whilst a volley of musketry is fired overhead.

The settled Afghans form the village communities, and in part the population of the few towns. Their chief occupation is with the soil. They form the core of the nation and the main part of the army. Nearly all own the land on which they live, and which they cultivate with their own hands or by hired labor.

As a race, the Afghans are very handsome and athletic, often with fair complexion and flowing beard, generally black or brown, sometimes, though rarely, red; the features highly aquiline. The hair is shaved off from the forehead to the top of the head, the remainder at the sides being allowed to fall in large curls over the shoulders. Their step is full of resolution; their bearing proud and apt to be rough.

The women have handsome features of Jewish cast (the last trait often true also of the men); fair complexions, sometimes rosy, though usually a pale sallow; hair braided and plaited behind in two long tresses terminating in silken tassels. They are rigidly secluded, but intrigue is frequent. In some parts of the country the engaged lover is admitted to visits of courtship, analogous to old Welsh customs.

The Afghans, inured to bloodshed from childhood, are familiar with death, and are audacious in attack, but easily discouraged by failure; excessively turbulent and unsubmitive to law or discipline; apparently frank and affable in manner, especially when they hope to gain some object, but capable of the grossest brutality when that hope ceases. They are unscrupulous in perjury, treacherous, vain, and insatiable, passionate in vindictiveness, which they will satisfy at the cost of their own lives and in the most cruel manner. Nowhere is crime committed on such trifling grounds, or with such general impunity, though when it is punished the punishment is atrocious. Among themselves the Afghans are quarrelsome, intriguing, and distrustful; estrangements and affrays are of constant occurrence; the traveller conceals and misrepresents the time and direction of his journey. The Afghan is by breed and nature a bird of prey. If from habit and tradition he respects a stranger within his threshold, he yet considers it legitimate to warn a neighbor of the prey that is afoot, or even to overtake and plunder his guest after he has quitted his roof. The repression of crime and the demand of taxation he regards alike as tyranny. The Afghans are eternally boasting of their lineage, their independence, and their prowess. They look on the Afghans as the first of nations, and each man looks on himself as the equal of any Afghan, if not as the superior of all others.

The political institutions of the Afghans present the rude and disjointed materials of a free constitution. The nation is theoretically divided into four great stocks, supposed to spring from four brothers. But these four divisions are practically obsolete, and only come up in genealogies. Each tribe has split into several branches, and in the more numerous and scattered tribes these branches have separated, and each has its own chief. They retain, however, the common name, and an idea of community of blood and interests.

The type of the Afghan institutions is perhaps best seen in some of the independent tribes near the British frontier. These cling most closely to the democratic traditions. Their rude state of society is held together by a code as rude, which is acknowledged, however, and understood by every one, and enforced by the community, every member of which considers its infringement as an act committed against his own privileges. The *Maliks* or chiefs are the representatives of the tribe, division or family to which they each belong, but they

possess no independent power of action, and before they can speak in council, they must have collected the wishes of the bodies which they represent.

Justice is administered in the towns, more or less defectively, according to Mohammedan law, by a *kāzi* and muftis.

A prominent law in this code is that called *Nana-watai*, or "entering in." By this law the Pathan is bound to grant any boon claimed by the person who crosses his threshold and invokes its sanctions, even at the sacrifice of his own life and property.

The Afghans are Mohammedans of the Sunni or orthodox body, with the exception of a few tribes, perhaps not truly Pathan, who are Shiah. They are very superstitious in regard to charms, omens, astrology, and so forth, and greatly addicted to the worship of local saints, whose shrines (*ziyarat*) are found on every hill-top. The shrine, a domed tomb, or mayhap a heap of stones within a wall, sometimes marks the saint's grave, but it is often a cenotaph. The saint may have been unknown in life for his virtues, but becomes after death an object of veneration, for reasons often hard to discern. In the immediate environs of Ghazni there are no less than 197 of these shrines.

A very marked feature in Afghan character is the passionate love for field sports, especially hawking. Deer-stalking in the open plains, the driving of game to well-known points by a host of beaters, and wild-fowl shooting with decoys, are others of their sports. They are capital horsemen, and unerring marksmen with the native rifle (*jezail*).

Among themselves the people are convivial and humorous. Festive gatherings are frequent, where they come together, not to buy or sell, or even to quarrel, but to make a noise and be happy. Tilting, shooting, racing, and wild music vary the amusements.

They have a wild dance called the *atan*, in which the men work themselves into great excitement. Among some Kakar tribes it is said the *atan* is sometimes danced by both sexes together.

Afghanistan is now, and has been before, under one prince, but it is hardly a monarchy as we are used to understand the term. It is rather the government of a dictator for life over a military aristocracy, and within this a congeries of small domesticities.

The revenues of Dost Mahommed Khan were estimated in 1857 at 4,000,000 rupees, or about £400,000. This included Afghan Turkestan, but not Herat, which he did not hold. The Herat revenue was estimated some years before (probably too low) at £80,000. In the later years of Dost Mahommed the net revenue is stated to have amounted to £710,000, of which the army cost £430,000.

Customs dues at Kabul and Kandahar are only 2½ per cent. nominally, but this is increased a good deal by exactions. There is a considerable tax on horses exported for sale, and a toll on beasts of burden exporting merchandise, from 6 rupees on a loaded camel to 1 rupee on a donkey.

According to the old system the Afghan forces were entirely composed of the *ulus*, or tribesmen of the chiefs, who were supposed to hold their lands on a condition of service, but who, as frequently as not, went over to the enemy in the day of need. As a counterpoise, the late Amir Dost Mahommed began to form a regular army. In 1858 this contained 16 infantry regiments of (nominally) 800 men, 3 of cavalry of 300 men, and about 80 field-pieces, besides a few heavy guns. The pay was bad, and extremely irregular, and punishments were severe. The men were fine, but recruited in the worst manner, viz., the arbitrary and forcible seizure of able-bodied men.

Persian is the vernacular of a large part of the non-Afghan population, and is familiar to all educated Afghans. But the proper language of the Afghans is *Pushtú*, or *Pukhtú* (these are dialectic variations).

There is a respectable amount of Afghan literature. The oldest work in Pushtu as yet mentioned is a history of the conquest of Swat by Shaikh Mâli, a chief of the Yusufzais, and leader in the conquest (A. D. 1413-24).

The literature is richest in poetry. Abdarrahmân (17th century) is the best known poet. Ballads are numerous.

The Afghan chroniclers call their people *Bani-Israil* (Arab. for children of Israel), and claim descent from King Saul (whom they call by the Mahommedan corruption *Tâlût*), through a son whom they ascribe to him, called Jeremiah, who again had a son called Afghâna.

And one of the Afghan Histories, quoted by Mr. Bellow, relates "a current tradition" that previous to the time of Kais, *Bilo*, the father of the Biluchis, *Uzbak* (evidently the father of the Uzbeks), and *Afghana*, were considered as brethren. As Mahommed Uzbeg Khan, the *eponymus* of the medley of Tartar tribes called Uzbeks, reigned in the 14th century, A. D., this gives some possible light on the value of these so-called traditions.

The most notable facts in later history must be briefly stated. In 1848, when the Sikh revolt broke out, Dost Mahommed, stimulated by popular outcry and by the Sikh offer to restore Peshawar, crossed the frontier and took Attok. A cavalry force of Afghans was sent to join Sher Singh against the British, and was present at the battle of Gujerat (21st Feb. 1849). The pursuit of the Afghans by Sir Walter Raleigh Gilbert, right up to the passes, was so hot that the Dost owed his escape to a fleet horse.

In 1850 the Afghans re-conquered Balkh.

In January 1855, friendly intercourse, which had been renewed between the Dost and British government, led to the conclusion of a treaty at Peshawar.

In November 1855, after the death of his half-brother, Kohandil Khan of Kandahar, the Dost made himself master of that province. In 1856 came the new Persian advance to Herat, ending in its capture, and the English expedition to the Persian Gulf. In January 1857 the Dost had an interview at Peshawar with Sir J. Lawrence, at which the former was promised arms and a subsidy for protection against Persia. In consequence of this treaty a British mission under Major Lumsden proceeded to Kandahar. The Indian Mutiny followed, and the Afghan excitement strongly tried the Dost's fidelity, but he maintained it. Lumsden's party held their ground, and returned in May 1858.

In 1863, Dost Mahommed, after a ten months' siege, captured Herat; but he died there thirteen days later (9th June), and was succeeded by his son Sher Ali Khan.

Since then the latter has passed through many vicissitudes in rivalry with his brothers and nephews, and at one time (1867) his fortunes were so low that he held only Balkh and Herat. By the autumn of 1868, however, he was again established on the throne of Kabul, and his competitors were beaten and dispersed. In April 1869 Sher Ali Khan was honorably and splendidly received at Amballa by the Earl of Mayo, who had shortly before replaced Sir J. Lawrence. Friendly relations were confirmed, though the Amir's expectations were not fulfilled. He received the balance of a donation of £120,000 which had been promised and partly paid by Sir John Lawrence. A considerable present of artillery and arms was made to him; since then some small additional aid in money and arms has been sent, but no periodical subsidy.

In 1870, the Ameer's eldest son, Yakub Khan, who had shown great ability as the governor of Herat, and had, on many occasions, given his father valuable assistance, broke into open rebellion against him. In 1873, Abdulla Jan was proclaimed heir-apparent, and in 1874, Yakub was imprisoned by his father at Kabul. For some time previous to 1878 there had been an estrangement between Shere Ali and the British government; he had then made overtures to Russia; and had welcomed at his capital a Russian mission. In consequence of these new relations with Russia, Shere Ali was invited to receive a British mission; his refusal led, after some fruitless negotiations, to war, and hostilities began by forcing the entrance to the Khyber Pass, toward the end of November. Severe fighting followed, but the English were everywhere successful. Before the end of December, Jelalabad was occupied without resistance, and Kandahar a little later. Shere Ali fled from Kabul to Turkestan, and died at Mazar-i-Sharif toward the end of February, 1879. Yakub Khan was proclaimed Ameer in the following month, and, on May 26th, signed a treaty of peace with the British at Gandamak. It was provided that the British representative should reside at Kabul, and that the British government should defend Afghanistan from foreign aggression, the Ameer receiving a subsidy; while the Kuram, Pishin and Sibi valleys, the Khyber and Michni passes, were to remain under the control of the British government as part of a line of scientific defensible frontier for India. This settled matters for a time, but in September of the same year, the revolted troops of the Ameer surrounded and attacked the British residency. The resident, Sir Louis Cavagnari, and his staff, with almost the whole of their Indian guard, were cut to pieces after a desperate and gallant resistance. Measures were immediately adopted for punishing this outrage. Sir F. Roberts, with a force of over 6,000 men, after defeating the Afghans at Charasia, twelve miles from Kabul, on October 6th, took possession of that city on the 12th, when Yakub Khan abdicated, and put himself under British protection. All went well for two months, but early in December there were gatherings of the tribes in the neighborhood of Kabul. Attempts to disperse them were defeated, and the British were beleaguered for ten days in their cantonments at Sherpur. The arrival of reinforcements, under General Gough, enabled them once more to take the field, and the war was continued in a desultory way.

In June, 1880, Ayub Khan, a younger brother of Yakub Khan, the ex-Ameer, proclaimed a ghaza, or holy war, and announced his intention of marching on Kandahar, then in the possession of the British. A brigade under Brigadier-General Burrows was sent against him. On the 27th of July Burrows marched to attack Ayub at Maiwand, and was completely defeated, with a loss of over 1,000 killed and wounded. A second reverse followed in August, when Brigadier-General Brooke's column was attacked, and had to retire with heavy loss, that officer being killed. Abdul Rahman Khan, who had been a pensioner of the Russian government, in Samarkand, from 1870 to 1880, in the meanwhile had come to terms with the British government, and had, in July, been recognized as Ameer. The withdrawal of the army of occupation had been decided on, when news of the Maiwand disaster was brought. To avenge this, General Roberts marched with a force from Kabul on August 9th, and reached Kandahar on the 31st. On the following day he totally defeated Ayub Khan, the Afghan camp, artillery and baggage falling into his hands, while Ayub himself escaped with a handful of horse. Before withdrawing, the British troops reduced to submission some

refractory tribes, and completed the evacuation of Afghanistan by the end of April, 1881. Abdul Rahman Khan, with the assistance of the British government, shortly after made himself master of the whole country.

Russia's proposal, in 1882, to delimit the frontier of Afghanistan, was received coldly in England. In July, 1884, however, a commission was appointed to demarcate the boundary between Afghanistan and the territory of the Turkomans. Gen. Sir Peter Lumsden was nominated by the British government, and General Zelenoi by the Russian. The line on which the commissioners were to be engaged was from Kwaja Sala on the Oxus, to Sarakhs. But after the annexation of Merv and the preliminary surveys of M. Lessar, in the valleys of the Khushk and Murghab, the Russian authorities took a different view. They contended that the Paropamisus was the true boundary of Herat, and that the district of Badghis, inhabited by Saryk Turkomans, who had professed their allegiance to the Czar, lay outside Afghan territory. Questions of such grave moment, it was further stated, required to be settled by the two European governments before the commissioners could enter on their duties, and General Zelenoi was, without further explanation, sent to Tiflis. General Lumsden waited for him for four months on the Murghab, with an escort of 500 men, besides followers. In the meanwhile, the Russian outposts were advanced so as to include part of the debatable land. By their occupation of Zulfikar, fifty miles south of Pul-i-Khatun, the outposts of the two nations were brought into immediate contact, and it was only through the urgent remonstrances of General Lumsden that a collision was avoided. Matters were further complicated by the attack on Panjdeh, near the fork of the Khushk and Murghab rivers, by a force under the command of General Komaroff, on March 30, 1885, and by his seizure of this important strategical position. During 1886 the demarcation of the frontier was proceeded with, and in April, 1887, the British and Russian commissioners met at St. Petersburg. After somewhat protracted negotiations, an agreement was effected, resulting in a compromise of the points at issue, concessions having been made on both sides. Russia obtained the valleys south of Panjdeh for nine or ten miles in the direction of Herat; on the other hand, the Ameer of Bokhara waived his claims to the pasture-lands on the left bank of the Amu Daria, south of Khoja Saleh. Russia now touches the northwestern frontier of Afghanistan, and has developed her railway communication in this direction with extraordinary rapidity. Meanwhile Great Britain has fortified and garrisoned Quetta in Beluchistan, on the southern frontier of Afghanistan, and connected it with India by a railway extended (1887) as far as Pishin. In 1887 troubles arose between the Ameer and rebellious Ghilzais and other subjects, and some severe struggles took place.

AFGHAN TURKESTAN is a convenient name applied of late years to those provinces in the basin of the Oxus which are subject to the Amir of Kabul. Badakhshan and its dependencies, now tributary to the Amir, are sometimes included under the name.

We do not know the precise divisions maintained under the Afghans, but they coincide generally with the old principalities or khanates, the hereditary rulers of which, in several cases, continue in authority under the Afghan governor of Turkestan. Bamian, Saighan, and the higher valleys, belong, it is understood, to a special command over the Hazara tribes.

AFIUM-KARA-HISSAR, a city of Asiatic Turkey, in pashalic of Anatolia, nearly 200 miles E. of Smyrna,

and 50 miles S.S.E. of Kutaiah. The population is estimated at about 60,000.

AFRAGOLA, a town of Italy, in the province of Napoli, 6 miles N.N.E. of Naples. Pop. 25,000.

AFRANIUS, LUCIUS, a Latin poet who lived about a century before Christ. He wrote comedies in imitation of Menander, and was commended by Cicero and Quintilian for his acute genius and fluent style.

AFRANIUS, LUCIUS, was a devoted friend and adherent of Pompey. In the year 60 B.C., and chiefly by Pompey's support, he was raised to the consulship. On the rupture between Caesar and Pompey, he was compelled to surrender to Caesar at Herda, 49 B.C., and was dismissed on promising not to serve again in the war. Afranius, regardless of his promise, joined Pompey at Dyrrhachium, and at the battle of Pharsalia, 48 B.C., he had charge of Pompey's camp. On the complete defeat of Pompey, Afranius repaired to Africa, and was present at the battle of Thapsus, 46 B.C., which ruined the hopes of the Pompeians in that part of the world. Escaping from the field, he was afterwards taken prisoner, and handed over to Caesar, whose veterans, disappointed at his not being led to immediate execution, rose in tumult and put him to death.

AFRICA, this vast continent, though associated from the dawn of civilization with traditions and mysteries of the most stimulating kind, has remained until recently one of the least known, and, both commercially and politically, one of the least important of the great divisions of the globe. The knowledge of Africa possessed by the ancients was very limited, owing principally to its physical construction. The great desert, which in a broad belt stretches quite across the continent, forbade every attempt to pass it until the introduction of the camel by the Arabs. The want of any known great river, except the Nile, that might conduct into the interior, contributed to confine the Greek and Roman colonists to the habitable belt along the northern coast. The Phœnicians are known to have formed establishments on the northern coast of Africa at a very early period of history, probably not less than 3,000 years ago; and the conquest of Egypt by Cambyes dates as far back as the year B.C. 525. We may consider, therefore, the coasts of Egypt, of the Red Sea, and of the Mediterranean, to have been settled and well known to the ancient Asiatics, who were constantly passing the narrow isthmus which divided their country from Africa and led them immediately from parched deserts into a fertile valley, watered by a magnificent river. But whether they were much or little acquainted with the western coast, which bounds the Atlantic, and the eastern coast, washed by the Indian Ocean, is a question that has exercised the research and ingenuity of the ablest scholars and geographers, and has not yet been satisfactorily answered.

The extent to which ancient discovery proceeded along the eastern coast of Africa, has divided the opinion of the learned nearly as much as its progress on the western coast. Delisle, Huet, and Bochart, made the discovery of the coast to extend as far south as Mozambique and Madagascar. D'Anville could trace such discovery no further than to Cape Delgado; and M. Gosselin contends that the ancients never proceeded down beyond Brava.

Egypt, under the Ptolemies, the great patrons of science and promoters of discovery, possessing the advantage of the only great river which falls from the African continent into the Mediterranean, made no progress beyond its ancient boundaries; and though the Romans, who subsequently possessed Egypt, penetrated beyond the limits of their own dependencies, they extended their discoveries no further than Fezzan



in one direction, and, at a later period, beyond Nubia as far as Abyssinia, and the regions of the upper Nile. We know nothing of the progress made by the Carthaginians in the discovery of Interior Africa; but although it has been asserted that their merchants had reached the banks of the interior river, which we call the Kaware or Niger, they have left nothing on record that will warrant such a supposition. The people from whom we derive the first information concerning the interior of Northern Africa are the Arabs, who, by means of the camel, were able to penetrate across the great desert to the very centre of the continent, and along the two coasts as far as the Senegal and the Gambia on the west, and to Sofala on the east. On this latter coast they not only explored to an extent far beyond any supposed limits of ancient discovery, but planted colonies at Sofala, Mombas, Melinda, and at various other places.

The 15th century produced a new era in maritime discovery. The voyages of the Portuguese were the first to give anything like an accurate outline of the coasts, and to complete the circumnavigation of Africa. The discovery of America and the West India islands gave rise to that horrid traffic in African negroes, which has since been suppressed; but this traffic has been the means of acquiring a more extended and accurate knowledge of that part of the coast which lies between the rivers Senegal and the Cameroons, as well as of the manners and character of the people who inhabit this extended line of coast.

During the last sixty years more has been done to make us acquainted with the geography of Africa than during the whole of the 1700 previous years since Ptolemy taken together. With Mungo Park, strictly speaking, commences the era of unceasing endeavors to explore the interior.

Mungo Park proceeded in 1795 from the river Gambia on the west coast, to the Joliba (commonly called Niger), traced this river as far as the town of Silla, explored the intervening countries, determined the southern confines of the Sahara, and returned in 1797. In 1805 this adventurous traveller embarked on a second journey in the same regions for the purpose of descending the river Joliba to its mouth. This journey added little to the discoveries already made, and cost the traveller his life. He is ascertained to have passed Timbuktu, and to have reached Boussa, where he was killed by the natives. In 1798 Dr. Lacerda, a scientific Portuguese traveller, who had already acquired fame through his journeys in Brazil, made the first great journey in South-Eastern Africa, inland from Mozambique, and reached the capital of the African king, known as the Cazembe, in whose country he died.

Hornemann, in 1796-98, penetrated from Cairo to Murzuk, and transmitted from that place valuable information respecting the countries to the south, especially Bornu. He then proceeded in that direction, but it is supposed that he soon afterward perished, as no accounts of his further progress have ever reached Europe. The first actual crossing of the continent that has been recorded was accomplished between the years 1802 and 1806, by two *Pombeiros* or mercantile traders in the employment of the Portuguese, who passed from Angola eastward through the territories of the Muata Hianvo and the Cazembe, to the possessions on the Zambeze. In 1816 an expedition was sent out by the English Government under the command of Captain Tuckey, to the river Congo, which was at that time believed to be the lower course of the Joliba. This proved disastrous and the geographical additions were but slight, the river having been ascended a distance of 280 miles.

The explorations of the latter half of the nineteenth century, actuated as they were by diverse motives, are

full of interest and have resulted in giving the world a great if not entirely complete knowledge of this vast continent.

In 1849 the English Government appointed James Richardson, an experienced African traveler, to the command of an expedition which was to start from Tripoli, and thence endeavor to penetrate to the central part of the continent. Two German naturalists, Doctor Barth and Mr. Overweg, accompanied the expedition. They penetrated to Mourzouk; then passed over the Sahara, visited the hilly oasis of Azben and its principal town, Agades. In 1851 they reached the Soudan midway between the Niger and Lake Tchad. Richardson and Overweg both died on the journey, but Barth pressed forward and gave to the world its first and most accurate knowledge of the Western Soudan. In 1854 he explored the Niger and visited Timbuctu. The next year he was joined by Dr. Vogel, who had been sent out to replace Mr. Overweg. For another year they carried on their labors together, and fixed the altitude of Lake Tchad and the latitude of Kouka. Their operations covered an immense field, embracing more than twenty-five degrees of latitude and as much of longitude. Doctor Barth's work is an inexhaustible mine of information concerning all this region.

From 1862 onward, many French travelers and soldiers have done much to solve the geographical problems of northwestern Africa, and in 1880 two Frenchmen, M. M. Moustier and Ziveifel, discovered the source of the Niger.

Many were the attempts to penetrate the basin of the Nile, but travelers ascending that stream were baffled for centuries. Finally two German missionaries opened the way from the east coast. Between 1847 and 1852 Doctors Krapf and Rebman traveled 100 leagues inland from the eastern coast, and discovered a high chain of mountains covered with snow. Rebman discovered Kilima-Njaro, and Krapf, Mount Kenia. Here they heard of great lakes lying beyond, and their reports, published in 1856, decided the London Geographical Society to send an expedition in that direction. It was placed under the command of Captains Burton and Speke, and in 1857 they left Zanzibar and traveled westward. The result of their expedition was the discovery of Lake Tanganyika and the Victoria Nyanza. In 1860 Speke and Grant made another journey to the great lakes, following substantially the same route as before. They reached the Victoria Nyanza, and, in 1863, entered upon the river issuing therefrom, and arrived at Gondokoro, where they met Col. Samuel Baker on his way up the Nile. Speke and Grant returned to England but Baker pressed onward up the Nile by a different route, and in 1864, discovered another lake which he named Albert Nyanza.

The news of these discoveries awakened great interest throughout Europe, and African travel was thenceforth undertaken with ardor. In every direction travelers pierced the continent. Doctor Schweinfurth, from 1869 to 1874, journeyed through the valley of the Nile, and penetrated beyond Khartoum, into the country of the Monbutus, or dwarfs, and the Nyam-Nyam. Schweinfurth's discoveries were of the highest value. Between 1869 and 1873 Sir Samuel Baker, under the auspices of the Khedive, made a second expedition up the Nile for the purpose of suppressing the slave traffic. On this expedition he completed the survey of Albert Nyanza.

David Livingstone's explorations began substantially in 1840, when he first went out to South Africa as a missionary, but it was not until 1849 that he crossed the great southern plateau, and discovered Lake Ngami. Between 1851 and 1854 he ascended the

Zambesi river for several hundred miles, and crossing the interior westward, reached Loanda on the Atlantic coast. He then retraced his steps to where he had left the Zambesi, and followed that stream to the east coast. On this journey he discovered Victoria falls. From 1858 until 1861 he was engaged in further explorations, traced with Mr. Kirk the source of the river Shire, and examined the country about Lake Nyassa. Returning to the Cape he made preparations for his last journey. He reached the Chambezi river, south of Tanganyika, in 1868. This river, under this name, falls into Lake Bemba or Bangweola. Thence it issues as the Luapula until it falls into Lake Moero, whence it issues as the Lualaba. Livingstone traced it through three lakes, and it was his belief that it was the true source of the Nile. We know it now to be the headwaters of the Congo. He was employed in these explorations and in traveling around Lake Tanganyika for several years, though nothing was heard from him in Europe, save disquieting rumors of his death.

In 1871, Henry M. Stanley, then a reporter on the New York *Herald*, was sent by his employer, James Gordon Bennett, to find Livingstone. He reached Zanzibar in January, 1871, organized a caravan, and started for Lake Tanganyika. It was not until the following November that he reached his destination and delivered supplies to Livingstone, then sorely in need of them. Stanley remained with Livingstone four months, making explorations around the lake, discovering the River Rusizi flowing into the north end of the lake. Stanley returned home, and Livingstone continued his explorations until May, 1873, when he died.

The travels of Livingstone, embracing a period of thirty years, added immensely to the domain of geographical knowledge, but all was not yet known. Interest was still aroused as to the relation of the great lakes to the Nile, and all the region about them was still a blank on the map of Africa.

In 1873 the Geographical Society of London resolved to continue Livingstone's explorations, and with that view sent out Lieutenant Cameron. His orders were to find Livingstone, if living, and place himself under his command. At Zanzibar he organized an expedition, three beside himself being Europeans. Marching westward through a difficult and often hostile country, he finally reached Tabora, or Kazeh, where he heard of Livingstone's death. He found Livingstone's last journals and papers, and sent them home. He then established himself at Ujiji, determined the altitude of Lake Tanganyika, made a survey of the south half of the lake, and proved that the Lake Liemba of Livingstone was identical with Tanganyika. He discovered an intermittent outflow from the lake, which he supposed flowed into the Lualaba. In his further explorations he came to the conclusion, which subsequently was proved to be correct, that Tanganyika and the Lualaba did not belong to the Nile system, as Livingstone supposed, but to the Congo. His observations showed that the Lualaba was at least one hundred feet below the level of the Nile at Gondokoro, while the discharge of water through it was five times as great. From the lack of boats Cameron could not actually verify his supposition, as Stanley afterward did. Cameron's researches proved of great value, for his observations were scientifically made and his maps showed latitude, longitude and altitude with accuracy.

Cameron was followed by an explorer whose discoveries have had a still greater celebrity. In 1874 Henry M. Stanley was sent, at the expense of the New York *Herald* and the London *Telegraph*, to continue Livingstone's explorations. No expense was spared to give exceptional advantages to the expedition. Organizing

at Zanzibar, Stanley visited the mountains that separate the basin of the Indian Ocean from Tanganyika and the Nile. He discovered the most southern source of the Nile, and explored the rivers Livumba and Shimiya. In the spring of 1875 he completely circumnavigated Victoria Nyanza, and surveyed its shores. Going south he discovered another large lake, the Muta Nzige, now known as Albert Edward Nyanza, and arrived at Ujiji on Lake Tanganyika. There he followed Cameron's route to Nyangwe on the Lualaba, upon which he launched his boat, *The Lady Alice*, in which he had sailed over the great lakes. The river swept to the north, but following the stream, though encountering many hostile savages, he descended to the Atlantic, thus proving the Lualaba and the Congo to be identical. His travels had lasted three years.

In 1879 Stanley was again sent out to Africa under the auspices of the International Association, at the head of which was the king of Belgium, for the purpose of founding the Congo Free State. Stations were established along the Congo river. Roads were built; and many of the affluents of the river were explored. The whole country is now being rapidly opened to trade.

Other explorers have also done much to add to our knowledge of Africa. Between 1859 and 1865 Du Chaillu made two expeditions from the Gaboon region into the interior, discovering the gorilla, and the Fan tribe of cannibals. De Brazza, a French naval officer, made several expeditions in the equatorial region and on the Congo between 1878 and 1880. A Portuguese explorer, Maj. Serpa Pinto, crossed the continent from Benguela to the Zambesi in 1877 and 1878. Doctor Holub, a Hungarian naturalist, made some valuable and interesting explorations in southern Africa in 1886-87. From the east coast the enterprise of travelers and explorers have been quite as great. In 1880 Joseph Thompson explored the region between Nyassa and Tanganyika, and, in 1884, made a journey from Mombasa, by Kilima-Njaro and Mount Kenia, across Masai land to Victoria Nyanza. In 1884 Mr. H. H. Johnston ascended Kilima-Njaro to the height of 16,200 feet. In 1885-86 Dr. G. A. Fischer, in his attempt to relieve Emin Pasha, reached north to Lake Baringo. In 1881-82 De Pogge and Lieutenant Wissmann crossed the continent from west to east, leaving Loanda and traveling to Nyangwe, which they reached in April, 1882. From here Wissmann continued his journey to Zanzibar, where he arrived in November, 1882, having crossed the whole of Africa in twenty-three months. The region passed through is one of great fertility, though the natives are savage and in some places practice cannibalism. Here is the great empire of the Muata Yamvo, which is drained by the Kasai and other tributaries of the Congo. It is the "sphere" now claimed by Portugal.

In 1885 Lieutenant Wissmann organized another expedition and returned to the Kasai river, exploring it into the Congo. Other travelers in the various quarters of the Congo region were Doctor Junker, Mr. Grenfell, Capello and Ivens, and Dr. Oscar Wolf.

The reports of the wonderful fertility and resources of the great lake region of the Upper Nile stimulated the khedive of Egypt to add all those provinces to his own. The Soudan and Equatoria were conquered and annexed to Egypt, and in 1874 General Gordon was appointed to rule over them. The seat of government was at Khartoum. One of Gordon's lieutenants was Edward Schnitzler, a Prussian Jew, a physician by profession, who had traveled and seen service in Turkey, Armenia, Syria and Arabia, and in 1876 had been employed by the khedive. He took the name of Emin Effendi, and, in

1878, Gordon appointed him governor of the Equatorial province, his capital being at Lado. There he remained through all the subsequent disasters that befell the Egyptian arms, including the fall of Khartoum and the death of Gordon, in December, 1884. After the death of Gordon the Mahdists began to threaten Emin Bey, or Emin Pasha, as he was then known, and he fell back from Lado south to Wadelai on the branch of the Nile which issues from Albert Nyanza. Here he became isolated from the world. For months and months he heard nothing from Egypt, though he knew the Soudan was in rebellion, and that his own safety was threatened. In December, 1886, a relief expedition was organized to carry supplies to him, and to escort him to the coast, if he desired to leave his post. The command of the expedition was given to Henry M. Stanley. After a discussion of the various routes by which the Albert Nyanza might be reached, that by way of the west coast and the Congo river was deemed the most advisable. Recruiting a force at Zanzibar, Stanley carried it by steamer around the Cape to the Congo, and thence up that river to its junction with the Aruwimi, and then up the Aruwimi to Yambuya, 1,300 miles from the sea. This point was reached June 15, 1887, and was to be the base of the expedition. Dividing his command, he left what was called the rear guard, under the command of Maj. Edmund Barttelot, and on June 28th, with the advance column, comprising 389 men, plunged into the great African forest, hitherto unknown and unexplored. The rear guard, composed of 129 men was to await further reinforcements and supplies, and was then to follow the advance. The objective point was Kavalli, a village at the southern extremity of Albert Nyanza, distant 330 geographical miles from Yambuya, estimated at 550 English miles. For 160 days Stanley marched forward with his men through jungle and bush and forest. He followed the course of the Aruwimi, which runs through the forest almost due east and west, and, afterward, of its confluent, the Ituri and the Ihuri. The column met with unparalleled hardships, and almost suffered complete starvation, so difficult was it to obtain sufficient supplies of food. From two to ten miles a day was the rate of travel, so difficult was it to make a road through the jungle. They passed through many villages of hostile tribes and had many skirmishes with them. In this great forest dwell the Pigmies, or Wambutti dwarfs. After incredible suffering and the loss of many men, the column emerged from the forest on December 5th and came out upon a beautiful grassy plain over which roamed buffaloes, antelopes, and other varieties of wild animals. Two miles to the east of where they emerged, a tall peak arose 4,600 feet above the sea, named by Stanley Mount Pisgah. A range of mountains lay further eastward, at the foot of which rolled the Albert Nyanza, the objective point of the expedition.

The natives of the grass-land were quite as hostile as the forest tribes, and several battles took place ere Stanley reached the lake. On December 14th he reached Kavalli, but he could learn no word of Emin. He had left his steel whale boat in the forest with a detachment of his men, unable to travel, and as Wadelai, where Emin was supposed to be, was a march twenty-five days' distant through a rocky and sterile country, Stanley deemed it most advisable to return for the boat, hoping also to hear some word of the rear guard left at Yambuya.

Back into the forest they went, and at West Ibbi built Fort Bodo, as a place of rest and safety, while a detachment was sent further back to Ungarowina for the boat. The return to the lake was accomplished by

April 18, 1888, when Stanley received a letter from Emin. On April 29th they met. After delivering a portion of supplies to Emin, Stanley turned back into the forest in quest of his rear guard, of which nothing had been heard. Through the width of the forest he again journeyed all the way to Banalya, but a short distance from Yambuya, the original starting point. There he found the remains of the rear guard in a terrible plight. Major Barttelot had been murdered, and all the European officers, except Mr. Bonny, were gone. More than half of the force had deserted or was dead. Reorganizing the command, Stanley led it through the forest and brought it, not without disaster and suffering, once more to Albert Nyanza. This great African forest stretches in unbroken density north and south 621 miles, with an average breadth of 517 miles. The sun can scarcely penetrate it. The trees, comprising almost every variety of wood, grow to an enormous height, some reaching 180 feet, while underneath there is a thick growth of bushes and vines. Innumerable insects swarm everywhere. Birds of many varieties inhabit the trees, while wild animals, all manner of reptiles, lemurs, chimpanzees, and baboons make their homes in its dark recesses. Added to these are the various tribes of the forest, among them the dwarfs, the most vicious and degraded of beings. They slay their enemies as well as their game with poisoned arrows. Many of Stanley's men fell victims to their poisoned arrows, or to poisoned skewers, deftly concealed in the pathway, upon which they would tread. The whole region reeks with disaster and death.

This forest Stanley crossed three times in this, the most memorable of all his expeditions. It was not until January, 1889, that he succeeded in bringing his forces, or what remained of them, to Kavalli. His various journeys through the forest occupied him nearly eighteen months. Three months more were occupied in making preparations to escort Emin Pasha and his people to the sea coast at Zanzibar. April 10th the caravan started from the southern extremity of Albert Nyanza and, December 4th following, safely reached Bagamonya. Stanley's quest, relief, and rescue of Emin were ended. Besides the nature and character of the great forest the discoveries made on this expedition were great and important. Chief among them was the discovery of the Ruwenzori range of mountains—the Mountains of the Moon—south of Lake Muta-Nzige, re-named Lake Albert-Edward by Stanley. This snow covered range, towering 16,000 feet above the sea, had never been noticed by any modern explorers of the lake region. It seems to have been known to the ancients, however, as the Mountains of the Moon. Its waters are drained into Lake Albert-Edward, and are thence discharged through the Semlika river into the Albert Nyanza. From this latter lake the White Nile issues.

This expedition of Stanley's leaves little to be discovered in Africa that is now absolutely unknown. All that remains to be done is detail, in the way of accurate measurements and observations.

The origin and meaning of the name of this great continent has been a fertile subject for conjecture among philologists and antiquaries. By the Greeks it was called Libya, and by the Romans Africa.

With respect to the word *Africa*, Suidas tells us that it was the proper name of that great city which the Romans called *Carthago*, and the Greeks *Karchedon*. It is certain, at least, that it was applied originally to the country in the immediate neighborhood of Carthage, that part of the continent first known to the Romans, and that it was subsequently extended with their increasing knowledge, till it came at last to include the whole

continent. Of the meaning of the name, the language of Carthage itself supplies a simple and natural explanation; the word *Afrygah*, signifying a separate establishment, or in other words a colony, as Carthage was of Tyre. So that the Phœnicians of old, at home, may have spoken of their Afrygah, just as we speak of our colonies. Be that as it may, the Arabs of the present day still give the name of Afrygah or Afrikiah to the territory of Tunis. It may also be remarked that the name seems not to have been used by the Romans till after the time of the first Punic war, when they became first acquainted with what they afterwards called *Africa Propria*.

Africa lies between the latitudes of 38° N. and 35° S., and is of all the continents the most truly tropical. It is, strictly speaking, an enormous peninsula attached to Asia by the isthmus of Suez. The most northern point is the Cape, situated a little to the west of Cabo Blanco, and opposite Sicily, which lies in lat. $37^{\circ} 20' 40''$ N., long. $9^{\circ} 41'$ E. Its southernmost point is Cabo d'Agulhas, in $34^{\circ} 49' 15''$ S.; the distance between these two points being 4330 geographical, or about 5000 English miles. The westernmost point is Cabo Verde, in long. $17^{\circ} 33'$ W., its easternmost Cape Jerdaffun, in long. $51^{\circ} 21'$ E., lat. $10^{\circ} 25'$ N., the distance between the two points being about the same as its length. The western coasts are washed by the Atlantic, the northern by the Mediterranean, and the eastern by the Indian Ocean.

The form has been likened to a triangle, or to an oval, but such a comparison is scarcely warranted, it being of an irregular shape, the northern half rounding off, the southern one contracting and terminating in a point.

The superficial extent of Africa has never been accurately determined, but may be taken at 9,858,000 geographical square miles, exclusive of the islands. It is larger than either Europe or Australia, but smaller than Asia and the New World.

The coast line of Africa is very regular and unbroken, presenting few bays and peninsulas. The chief indentation is formed by the Gulf of Guinea, with its two secondary divisions, the Bight of Benin and the Bight of Biafra. On the northern coast, the Gulf of Sidra and the Gulf of Kabes must be mentioned, and on the eastern coast the Gulf of Arabia.

The physical configuration may be considered under two heads, the great lower-lands and plains of Northern Africa, and the great table-lands, with their mountain ranges and groups, of Central and Southern Africa. The great northern lower-land comprises the Sahara, the Lake Chad region, and the valley of the Lower Nile. The Sahara is by no means a plain throughout, but for the greater part it rises into table-lands, interspersed with mountain groups of 6000 feet elevation, and probably more, and the term lower-lands can only be applied to it in a general way, to distinguish it from the more elevated region to the south.

The great mass of the African plateau land is to southward of the 10th parallel of N. latitude, but it is prolonged on the eastern side almost to the north coast of the continent by the wedge-shaped table-land of Abyssinia, the highest surface in Africa, and by the mountains which extend from it between the lower course of the Nile and the Red Sea. The terminal point of the high land in this direction may be said to be Jebel Attaka, which rises immediately west of Suez to a height of 2640 feet. From this point to the southern extremity of the continent the eastern and generally higher edge of the great plateau runs in an almost unbroken line. Passing southwards along its margin, the most prominent heights before the table-land of Abyssinia is reached are Mounts Elba, 6900, and Soturba,

6000 feet in the elevation, near the middle of the African coast of the Red Sea. There may, however, be greater heights in the little known region of Nubia, which lies between these mountains and the Nile.

The eastern slope of the Abyssinian plateau begins immediately south of the port of Massowah, and is a uniform line of steep descent, unbroken by any river, falling abruptly from an average height of 7000 feet to the depressed plain which here skirts the coast of the Red Sea. This edge, which extends southward for at least 800 miles, forms the water-parting of the rivers which have furrowed deeply into the opposite slopes of the plateau, and appears to be higher than the general surface of the country; yet several lofty groups of mountains rising from the level of the high land attain a much greater elevation, and Mount Abba Jared, the highest known point, is estimated at 15,000 feet above the sea. Between the most southern part of Abyssinia which is known, and the equator, where the edge of the plateau has again been partly explored, a long space of unknown country intervenes; but there is every reason to believe that the slope is continuous. Mount Keni, 18,000 feet and Kilima-njaro, 18,715 feet, the highest points in all Africa, mark the eastern edge under the equator; further south on the inland route from Zanzibar to the Tanganyika the edge is known as the Rubeho Mountains, with a height of 5700 feet at the pass by which they are crossed on the caravan route. Still further, the edge is again known where it forms a rampart, called the Njesa, walling in the Nyassa Lake. From this point Mount Zomba, 7000 feet high, near Lake Shirwa, Mount Milanje, 8000 feet, and Mount Clarendon, 6000 feet, carry it south to where the Zambeze river makes the first break in its uniform line. The narrows and rapids of Lupata, below the town of Tete, mark the point at which the river breaks through the plateau land to the coast slope beneath it. Passing the river, the eastern edge is again followed in the Mashona and Matoppo Mountains (7200 feet) of Mosilikatse's kingdom, from which heights the chief tributaries of the Limpopo river flow. At the head-waters of that river the plateau edge forms the Hooqe Veldt of the Transvaal Republic, which joins with the Kathlamba or Drakenberg. The portion of the edge which bears this name is specially prominent; it runs southward in a huge wall of rocky crags which support the table-land behind for 500 miles, almost parallel with the coast, and at a distance of 150 miles from it, having Zulu Land, Natal, and Caffraria on the slopes of the spurs which it throws down to the coast. In the Transvaal Republic, where the Drakenberg joins the Hooqe Veldt, the edge attains a height of 8725 feet in the summit named after the explorer Mauch, but it is highest where it forms the interior limit of Natal, and where Cathkin Peak rises to 10,357 feet above the sea.

The western edge of the great African plateau is generally lower than the eastern, since the whole slope of the continent is more or less from the great heights on its eastern side, towards the west, but it is also clearly traceable, and of great height throughout.

The northern edge of the great African plateau is almost unknown; but there are evidences that it runs eastward between the 4th and 8th parallels of N. latitude, to a point at which it is well known, and where the Nile falls over its slope, forming the succession of rapids above Gondokoro.

The general elevation of the surface of the great African plateau, the limits of which have now been traced, may be taken at from 3000 to 4000 feet above the sea; but its surface presents very great undulations, from the depressions which are occupied by some of the great lakes, to the high mountains which rise above its average level.

The African continent, as far as it has yet been explored, seems to be the portion of the globe least disturbed by volcanic action. The known active volcanoes in the continent are those of the Cameroon Mountains, on the coast of the Gulf of Guinea in the west, and the Artali volcano in the depressed region of the salt desert which lies between the Abyssinian plateau and the Red Sea.

Among the minerals of Africa, salt is widely distributed, though in some districts wholly wanting. Thus, in the Abyssinian highland the salt, which is brought up in small blocks from the depressed salt plain on the Red Sea coast beneath, is so valued as to be used as a money currency; and in the native kingdoms of South Central Africa, the salt districts are royal possessions strictly guarded. Metals seem nowhere very abundant. Gold is perhaps the most generally distributed. The gold-fields of the Transvaal Republic and of the country which extends thence to the Zambeze, are numerous; but no yield has as yet been discovered of sufficient quantity to overcome the difficulties of working, and of transport to the distant sea-ports, to which no navigable rivers lead from this region. Copper is known to exist in large quantities in the mountains of native kingdoms of the centre of South Africa; and one of the objects of Dr. Livingstone's journey was to visit the famed copper country of Katanga south-west of the Tanganyika Lake. The diamond-fields in the districts of the Vaal and Orange rivers north of Cape Colony have been steadily worked, and for a time gave good returns.

Africa is the only one of the continents of the globe which lies equally to north and south of the equator, and the portions of it which extend beyond the tropics do not advance far into the temperate zones. From this it results that Africa, besides being the warmest of all the continents, has also the most equal distribution of the sun's heat during the seasons over the parts which lie north and south of the central line. Winds and rain, depending on the distribution of heat, are also correspondingly developed in these two great divisions of the continent, and the broad landscape zones, passing from humid forest to arid sandy desert, also agree exactly with one another north and south of Equatorial Africa.

Between 10° N. and 10° S. of the equator, but especially in that portion of it the outskirts of which have only as yet been reached by travellers, Africa appears to be a land of dense tropical forest. Wherever it has been penetrated, travellers speak of an excessively rank vegetation; passage has been forced through thick underwood and creeping plants, between giant trees, whose foliage shuts out the sun's rays; and the land teems with animal and insect life of every form and color.

The extremities of the continent, to which moisture is carried from the neighboring oceans, again pass into a second belt of pastoral or agricultural land, in the northward slopes of the plateaus of Barbary, Morocco, Algeria, and Tunis, corresponding with the seaward terraces of cultivated land in the Cape Colony in the south.

Taking a broad view of the hydrography of Africa, there are two great areas of continental drainage, one in the north, and the other in the south, from which no water escapes directly to the ocean. These correspond almost exactly with the two desert belts of the Sahara and the Kalahari above described. The whole of the remaining portions of the continent, its forests and pastoral districts, in which the greater rainfall gives greater power to the rivers, are drained by streams which find their way to the ocean on one side or other, generally forcing a passage through some natural or waterworn gorge in the higher circle of mountains which run round the outer edges of the great plateau.

It must be noticed that the capabilities of the African

rivers, as highways of approach to the interior of the continent, are exceedingly small in comparison with those of the other great continents of the globe, most of them being either barred at their mouths, or by rapids at no great distance from the coast. It is owing to this physical cause mainly that the African continent has remained for so many centuries a sealed book to the civilised world. On the other hand, it must be observed, that when these outer barriers have been passed, the great interior of the land, in its most productive regions, possesses a network of vast rivers and lakes, unsurpassed in extent by those of any country of the world, by means of which the resources of Central Africa may in future be thoroughly developed.

The Nile is the oldest of historical rivers, and afforded the only means of subsistence to the earliest civilised people on earth, and yet the origin of this river remained an enigma almost to the present day. Though it drains a larger area than any other river of Africa, upwards of 1,000,000 square miles, and in this respect is one of the largest rivers of the globe, the Nile, passing for a great portion of its lower course through the desert belt of North Africa, and receiving no tributaries there, loses much of its volume by evaporation, and is far surpassed in the quantity of water conveyed to the ocean by the Congo, in the most equatorial zone. The opinions advanced by Dr. Livingstone in regard to the head-waters of the Nile have not been confirmed by the recent explorations of Stanley. Two facts have been established—(1) that Lake Victoria Nyanza is not a portion of the Nile system, but belongs to the Congo, and (2) that it is not connected with Lake Tanganyika. The delta of the Nile, from which a multitude of canals are drawn off, is a wide, low plain, occupying an area of about 9000 square miles. The most remarkable circumstance connected with the delta is the annual rise and overflow of the river, which takes place with the greatest regularity in time and equality in amount, beginning at the end of June, and subsiding completely before the end of November, leaving over the whole delta a layer of rich fertilising slime.

The Shelif in Algeria, and the Muluya in Eastern Morocco, are the chief streams flowing to the Mediterranean from the high land of Barbary.

Passing round to the Atlantic system, the Sebu, the Ummer Rebba, and the Tensift, from the Atlas range, are permanent rivers flowing across the fertile plain of Western Morocco, which they serve to irrigate. Next is the Wady Draa, a water-course which has its rise on the inner slope of the high land in Morocco, and which bends round through the Moroccan Sahara to the Atlantic, near the 28th parallel. Its channel, of not less than 500 miles in length, forms a long oasis in the partly desert country through which it flows, and water remains in its bed nearly throughout the year.

A stretch of 1100 miles of waterless coast, where the desert belt touches on the Atlantic, intervenes between the Draa and the Senegal river, at the beginning of the pastoral belt in lat. 15° N.

The Senegal rises in the northern portion of the belt of mountains which skirt the Guinea coast, and has a northwesterly course to the sea. During the rainy season it is navigable for 500 miles, from its mouth to the cataract of Feloo, for vessels drawing 12 feet of water, but at other times it is not passable for more than a third part of this distance. The Gambia has its sources near those of the Senegal, and flows westward in a tortuous bed over the plain country, giving a navigable channel of 400 miles, up to the Falls of Barra Kunda. The Rio Grande, from the same heights, is also a considerable river.

The Niger is the third African river in point of area

of drainage and volume; it is formed by the union of two great tributaries, the Quorra of Benue, the former from the west, the latter from the country in the east of the river basin. The Quorra, called the Joliba in its upper course, has its springs in the inner slope of the mountains which give rise to the Senegal and Gambia, not far from the Atlantic coast. At first its course is north-eastward to as far as the city of Timbuctu, on the border of the desert zone; then it turns due east, and afterwards southeast to its confluence with the Benue, at a point 200 miles north from the coast of the Gulf of Guinea. The chief tributary of the Quorra is the Sokoto river, coming from the elevated country which forms the water-parting between the Niger basin and that of Lake Chad on the east, and its confluence is near the middle of the portion of the channel of the Quorra which bends to the south-east.

At a distance of about 100 miles from its sources, the traveller Park, the first European who reached the Joliba, found it flowing in a wide fertile valley, and navigated by canoes which kept up a constant traffic. Above Timbuctu the commerce of the river is busily carried on in barges of 60 to 80 tons burden; further on, where the river touches upon the desert belt in the most northerly portion of its course, its fertile banks form the most marked contrast to the arid desert lands beyond. The delta is much more extensive than that of the Nile, and measures about 14,000 square miles of low alluvial plain, covered with forest and jungle, and completely intersected by branches from the main river, the outmost of which reach the sea not less than 200 miles apart. Unlike the Nile, the Niger possesses one main channel through the centre of the delta, called at its mouth the Nun river.

Old Calabar river, the Camaroon river, and the Gaboon, are the best known of a number of wide inlets or estuaries of the sea, which occur on the west coast immediately north of the equator; but these are merely the receptacles of a number of minor streams, not the mouths of great rivers, as at one time supposed.

The Ogowai (pron. Ogowee) river, the delta of which forms Cape Lopez, immediately S. of the equator, is a great stream which is believed to drain a large area of the forest zone between the Niger and the Congo; as yet, its lower coast is only known to a distance of 200 miles from the sea. Above the delta the main stream of the river, named the Okanda, breaks through the edge of the plateau, and is joined by the Onango, a tributary from the coast range of the Sierra Complida. Below this confluence the river is a mile and a half in average width, its depth varying from 15 to 50 feet. The delta is formed by the two main branches into which the Ogowai divides at about 30 miles from the coast, and is a swampy flat, covered with mangroves.

The Congo or Zaire must be considered the second river of Africa in point of area of drainage, and it is the first in respect of the volume of water which it discharges to the ocean. There remains now no doubt that the head waters of this vast river are those of the great freshwater lake, Victoria Nyanza, supposed by Livingstone to belong to the Nile system.

The Coanza, the most important river of Angola, in respect of its affording a navigable channel for 140 miles from its mouth, rises in a broad valley formed by the Mossamba Mountains in the interior of Benguela, and curves north-westward to the ocean.

The Orange river also belongs for the greater part of its lower course to the water-courses of the arid belt, but it receives such a constant supply from its head streams, which descend from the high lands near the east coast of the continent, as to be able to maintain a perennial flow in its channel, which, however, is so

shallow as to be of no value for navigation. Its main head streams are the Vaal and Nu Gariep or Orange, which rise on the opposite slopes of one of the summits of the Crakenberg range, called the Mount aux Sources. After encircling the Orange River Free State, these rivers unite near the centre of this part of the continent to form the Orange, which continues westward to the Atlantic, but without receiving any permanent tributary.

The first large river of the Indian Ocean system is the Limpopo or Crocodile river, so named from the great number of these animals found in its bed. Its basin lies centrally in the southern tropic, also in the desert belt, and on this account it barely maintains a shallow flow of water throughout the year.

The Zambeze is the great river of the pastoral belt of South Africa, and the fourth in point of size in the continent, draining nearly 600,000 square miles.

The Rovuma, which has its chief tributaries from the plateau edge on the eastern side of Lake Nyassa, is the next great river of the drainage to the Indian Ocean.

Still further north the mouths of a great river named the Rufiji are known, on the coast opposite the island of Monfia, south of Zanzibar.

The Kingani and the Wami are two streams from the plateau edge, in the country of Usagara, and reach the sea in the channel formed by Zanzibar island. The Pangani river, further north, rises in the snowy mountain Kilimanjaro. The Sabaki and Dana, which embouch on the opposite side of Formosa Bay, in 3° S., flow over the same coast plains, having their head springs in the spurs of Mount Kenia. The latter river might be navigated during the rainy season 100 miles from the coast.

The Juba river is the most considerable on the eastern side north of the equator. No permanent rivers reach the Red Sea from the Abyssinian highlands or from the heights of Nubia which continue these northward; the largest water-course is that of the Barca, which is periodically filled by its tributaries in the northern part of the Abyssinian plateau.

Turning now to the great areas of continental drainage, it is observed that in North Africa there is a vast space of upwards of four millions of square miles, extending from the Nile Valley westward to the Atlantic coast, and from the plateau of Barbary in the north to the extremities of the basin of Lake Chad in the south, from which no single river finds its way to the sea. The whole of this space, however, appears to be furrowed by water channels in the most varied directions.

Lake Chad, on the margin of the pastoral belt, is supplied by a large river named the Shari, coming from the moist forest country which lies nearer the equator; and the lake, which till recently was believed to have no outlet, overflows to north-eastward, fertilizing a great wady, in which the waters become lost by evaporation as they are led towards the more arid country of the Sahara.

The southern area of continental drainage is of much smaller extent, and occupies the space of the desert zone which lies between the middle of the Zambeze basin and Damara Land.

Smaller spaces of continental drainage exist at various points near the eastern side of the continent. One of these occupies the depressed area between the base of the Abyssinian highland and the Red Sea, and is properly a continuation of the Sahara desert belt beyond the intervening plateau. In this space the Hawash river, descending from the plateau, terminates before reaching the sea. Another interior basin lies in the plateau between the edge on which mountains Kenia and Kilimanjaro rise and the country east of the Victoria Lake, and includes several salt lakes.

The great lakes, which form such a prominent feature

in African hydrography, are found chiefly in the southern and eastern regions of the continent, but they are distributed over all the systems of drainage. The Victoria and Albert Lakes of the Central system are great seas of fresh water; and the recent expedition of Stanley proves that they rival the great American lakes for the place of the greatest expanse of fresh water on the globe. The former, the Victoria Lake, now admittedly the largest freshwater lake, is at an elevation of about 3,300 feet above the sea; and its outline, as at present sketched on our maps, occupies an area of not less than 30,000 square miles. The Albert Lake, 2,500 feet above the sea, is believed to have an extent not far short of this. Lake Baringo, north-east of the Victoria, is reported to be a great fresh lake, discharging towards the Nile by a river which is possibly the Sobat tributary. Lake Tzana or Dembea, 60 miles in length,, at a level of 6,000 feet above the sea, on the Abyssinian plateau, is the only remaining great lake of the system.

The great expansions of the Chambeze-Lualaba river, presumably belonging to the river Congo, are the only other considerable lakes of the Atlantic drainage. The highest of them, Lake Bangweolo or Bemba, is described as being 150 miles in length from east to west, and at an elevation of 4000 feet; Lake Moero, the next, extends through 60 miles; Lakes Kamalondo or Ulenge, and the yet unvisited lakes of the same drainage, are described as of vast extent, and lie at an elevation of about 2000 feet above the sea.

Belonging to the drainage system of the Indian Ocean are, Lake Nyassa, 1500 feet above the sea, and stretching meridionally over an area of nearly 9000 square miles in the basin of the Zambeze; and Lake Samburu, a reported lake of great extent, lying in the plateau edge north of Mount Kenia, and probably belonging to the basin of the Juba river. The great Lake Tanganyika, upwards of 10,000 square miles in area, and united by a broad channel with Lake Liemba in the south, occupies a deep longitudinal basin, girt with mountains; it is 2800 feet above the sea level.

Lake Chad, the greatest lake of the continental system of North Africa, is a shallow lagoon of very variable extent, with numerous islands; it lies at about 1100 feet above the sea; its waters are fresh and clear, and its overflow is carried off to north-eastward by the wady named Bahr-el-Ghazal.

Lake Ngami, the corresponding lake in the southern continental system, at an elevation of about 2900 feet, is also a shallow, reedy lagoon, varying in extent according to the season. The Zuga river carries off its surplus water to eastward. Salt lakes are of frequent occurrence in the areas of continental drainage; perhaps the most remarkable of these is the Assal lake, which lies in a depression east of Abyssinia comparable with that of the Dead Sea, 600 feet beneath the level of the Red Sea; the Sebka-el-Faroon or Schott Kebir, south of Tunis, is a great salt lagoon, 100 miles in length, dried up in summer, when its bed is found to be thickly encrusted with salt, and in winter covered with water to a depth of two or three feet.

Africa lies almost entirely in the torrid zone, and is the hottest continent of all. The greatest heat, however, is not found under the equator, since the whole of the central belt of the continent is protected by a dense covering of forest vegetation, supported by the heavy rainfall, and has in consequence a more equable climate, but in the dry, bare, exposed desert belts, which lie on the margins of the tropics, the Sahara in the north and the Kalahari in the south, where the climate is extreme. The highest temperature is found throughout the Sahara, particularly in its eastern portions toward the Red Sea. In Upper Egypt and Nubia eggs may be baked in the

hot sands; and the saying of the Arabs is, "in Nubia the soil is like fire and the wind like a flame." The regions along the Mediterranean and Atlantic coasts are rendered more temperate by the influence of the sea. To the south of the Great Desert the temperature decreases, chiefly on account of the increasing moisture and protection of the land surface from extreme heating by its tree growth, but also because of the greater elevation of the land as the great southern plateau is approached.

Africa is not much under the influence of the regular winds, except the monsoons of the Indian Ocean, the great movement of the atmosphere depending chiefly on the oscillation of the continent beneath the sun during the seasons, as will be afterward explained. The wind currents over the whole continent have a prevailing direction from the east. There are the trade winds, modified by interruptions of changing heat and elevation of the land surface. In the northern part of the Indian Ocean the year is divided between the south-west monsoon, blowing from March till September, away from Africa, towards the then heated continent of Asia; and the north-east monsoon, or rather the normal trade wind, blowing towards the African coasts, from October till February.

In Africa the dependence of the winds and rains upon the movement of the land beneath the sun is more clearly marked than in any other intertropical region of the globe. The high temperature caused by the vertical heat of the sun over a particular area induces an indraught of air to that place, an ascending current is produced which carries up with it the warm and moist air; condensed in the higher regions of the atmosphere, the moisture falls as rain, and the condensation makes way for a further indraught.

On the eastern coast-land the rains are more dependent on the direction of the monsoon winds; about the mouths of the Zambeze and on the Mozambique coast the rains begin in November, after the north-east monsoon wind has set in over the northern part of the Indian Ocean, bringing with it the vapors drawn from the sea to condense on the coast slopes. The rains continue here till March, when the south-west monsoon begins to blow away from the land towards the then heated surface of Asia.

The Sahara, and also the Kalahari of Southern Africa, are almost rainless regions, but wherever a sufficient elevation occurs to intercept a cooler stratum of the atmosphere, rain is not wanting, even in the midst of the Great Desert.

The causes of want of rainfall in the vast region of the Sahara appear to be mainly these—that the winds advancing towards it come from a cooler and moister to a warmer and drier region, indeed to the hottest and driest of all, and so are constantly losing in moisture and gaining in temperature as they approach; the high plateau of Abyssinia forms an effective screen from the winds of the Indian Ocean, wringing out their moisture before the Sahara is reached, and on the Atlantic side the north-east trade wind constantly blows away from the land; a barrier of mountains also deprives the Sahara of rain from the south-west. Another cause of dryness is the low level of great areas of the Sahara.

Although Africa belongs almost entirely to the torrid and warm zones, its vegetable productions are essentially different in different parts. Thus, in the extreme north, groves of oranges and olives, plains covered with wheat and barley, thick woods of evergreen oaks, cork-trees, and sea-pines, intermixed with cypresses, myrtles, arbutus, and fragrant tea-heaths, form the principal features of the landscape. On this northern coast the date-palm is first found; but its fruit does not arrive at perfection, and it is chiefly valued as an ornamental

object in gardens. Various kinds of grain are cultivated. Beyond this region of the coast and the Atlas chain, with the borders of the Sahara, commences a new scene. It is in this region, extending to the borders of Soudan, that the date-tree forms the characteristic feature. Being peculiarly adapted to excessive dryness and high temperature, it flourishes where few other plants can maintain an existence. Were it not for the fruit of the invaluable date-tree, the inhabitants of the desert would almost entirely depend on the products of other regions for their subsistence. With the southern boundary of the Sahara, the date-tree disappears, the baobab or monkey bread-tree takes its place, and, under the influence of tropical rains, a new, rich, and highly-developed flora presents itself. These trees, together with huge cotton-trees, oil-palms, sago-palms, and others of the same majestic tribe, determine the aspect of the landscape. Instead of waving fields of corn, the cassava, yam, pigeon-pea, and the ground-nut, form the farinaceous plants. The papaw, the tamarind, the Senegal custard apple, and others, replace the vine and the fig. In Southern Africa, again, the tropical forms disappear, and in the inland desert-like plains, the fleshy, leafless, contorted, singular tribes of kopsias, of mesembryanthemums, euphorbias, crassulas, aloes, and other succulent plants, make their appearance. Endless species of heaths are there found in great beauty, and the hills and rocks are scattered over with a remarkable tribe of plants called *Cycadaceæ*. Plants of the protea tribe also add to the extraordinary variety in the vegetable physiognomy of that region.

The most important members of the quadrumana family are the anthropoid monkeys, the chimpanzee and gorilla, in Tropical and Western Africa. Baboons and mandrills, with few exceptions, are peculiar to Africa. Only a few species of the genus *Macacus*, which is East Indian, are found in Africa. The only short-tailed species (*Macacus Inuus*) is North African, and is also found wild on the opposite coast at the Rock of Gibraltar. In Madagascar the place of the true monkeys is supplied by the peculiar tribe of the true Lemurs or makis. Many species have close affinities with those of Asia; thus the orang-outang of Borneo is represented in Africa by the chimpanzee. The gibbons are entirely wanting.

Of the large Carnivora the bear is almost entirely wanting, and occurs only sparingly in the Atlas Mountains in Barbary. The true martens are unknown, but otters occur. Of the *Canis* family the jackal is characteristic, and roams over the whole of Africa. It differs from the Asiatic species in its paler skin, which approaches the color of the prevailing deserts. The wolf and fox do not extend beyond the northern margin of Africa. Hyænas are true African tenants; the striped hyæna extending from Asia over North Africa, the spotted hyæna over the remainder of the continent; in the southmost part of the continent the brown hyæna is also found, and with it the aardwolf, or earth wolf of the Cape colonists, allied to this genus. Africa is the chief home of the lion, which there remains undisturbed as king over the lower animal creation, though it has been driven inwards from the more settled portions of the coast land, while in the extreme south-western parts of Asia, to which it is now confined, its power is divided with that of the tiger. The leopard, serval, caracal, chaus and civet cat (the locality of the true civet being North Africa), are the other principal representatives of the cat tribe. The herpestes or ichneumons have the same distribution as the civets; the species which destroys the eggs of the crocodile is found in Egypt and the North of Africa.

Of wild horses the asinine group is characteristic of

Asia, and the hippotigrine of Africa. The quagga, exclusively African, inhabits the most southern parts of the continent, and is scarcely found north of the Orange river, but occurs in great herds associated with the white-tailed gnu; the zebra (*Equus Burchellii*), or zebra of the plains, is widely distributed over Africa, from the limit of the quagga to Abyssinia and the west coast; the zebra of the mountains (*Equus zebra*), more completely striped than the rest, is only known in South Africa. The true onager or aboriginal wild ass is indigenous to North-East Africa and the island of Socotra. A species inhabiting the high land of Abyssinia is distinct from these. The horse, domesticated in other parts of Africa, excepting the region of forests, is not found in the eastern intertropical region; and, for some cause not yet clearly ascertained, it appears to be impossible to acclimatise it there. The single humped camel or dromedary is used over the whole of North Africa, as far south and west as the river Niger and Lake Chad. The Indian buffalo has spread by introduction to North Africa; the Cape buffalo, a species peculiar to Africa, reaches as far north as a line from Guinea to Abyssinia; the *Bos Brachycerus* is a species peculiar to West Africa, from Senegal to the Gaboon. Of sheep, the *Ovis Tragelaphus* is peculiar to North Africa; the Ibex goat extends into Abyssinia. The family of the antelopes is essentially African, five-sixths of the species composing it being natives of that country, and chiefly of the portion lying south of the Sahara, occurring in dense herds. Lastly the giraffe, one of the most celebrated and characteristic of African quadrupeds, ranges from the limits of the Cape Colony as far as the Sahara and Nubia.

The ornithology of Africa presents a close analogy in many of its species to those of Europe and South Asia. Thus, on its northern coast, there is scarcely a single species to be found which does not also occur in the other countries bordering on the Mediterranean. The ornithology of the region of the Nile and the northern coasts is identified with that of Arabia, Persia and Spain. The deserts are inhabited by species adapted to its solitudes; while Southern Africa presents different species.

The ostrich, the hugest of birds, which has been described as the feathered camel, or the giraffe among birds, is found in almost every part of Africa. But its chief home is the desert and the open plains; mountainous districts it avoids, unless pressed by hunger.

The large messenger or secretary-bird, which preys upon serpents and other reptiles, is one of the most remarkable African birds. It is common near the Cape, and is not seldom domesticated.

Among the smaller birds of Africa are many species remarkable for the gaudiness and brilliancy of their plumage, or the singularity of their manners and economy. Of the former kind may be mentioned the sun-birds, the lamprotornis, the bee-eaters, the rollers, the plantain-eaters, the parrots, the halcyons, and numerous smaller birds that swarm in the forests.

Though Africa is not exempt from the scourge of venomous or dangerous reptiles, still it has comparatively fewer than other tropical countries, owing to the dryness of the climate. The reptiles harbored by the desert regions consist chiefly of harmless lizards and serpents of a small size, though often venomous. The frog and tortoise tribes are represented in but few species and numbers.

The most important among the reptiles is the crocodile, which inhabits nearly all the large rivers and lakes within the tropics, and is still abundant in the Nile below the first cataract.

The chameleon is common in Africa. Among the venomous species of snakes are the purple naja, the

cerastes or horned viper, the ringed naja, and the darting viper.

Edible fish are found almost everywhere in great variety and quantity. The fresh waters of Egypt produce the gigantic bishir, the coffres, and numerous species of the pimelodes. Many varieties of fish exist in the great interior lakes; five large species found in the Tanganyika are described by Burton. The greater number of the fish of the Red Sea resemble the Saxatiles of the warm seas of Asia. On the west coast are found the fish belonging to equatorial latitudes, while the shores of the Mediterranean produce those of France and Spain. The seas of the southern extremity possess the species common to the latitudes of the antarctic, south of the three great capes. The fish of the east coast are the same as those of the Indian Sea.

Of the insect tribes Africa also contains many thousand different kinds. The locust has been, from time immemorial, the proverbial scourge of the whole continent; scorpions, scarcely less to be dreaded than noxious serpents, are everywhere abundant; and the zebub, or fly, one of the instruments employed by the Almighty to punish the Egyptians of old, is still the plague of the low and cultivated districts. In the interior of Africa a venomous fly occurs in certain regions of the south and east, which is fatal to nearly all domestic animals. It is called tsetse (*Glossina morsitans*), and its size is almost that of the common blue fly which settles on meat; but the wings are larger.

From the shores of the Mediterranean to about the latitude of 20° N., the population of Africa consists largely of tribes not originally native to the soil, but of Arabs and Turks, planted by conquest, with a considerable number of Jews, the children of dispersion, and the more recently introduced French. The Berbers of the Atlas region, the Tuaricks and Tibbus of the Sahara, and the Copts of Egypt, may be viewed as the descendants of the primitive stock, while those to whom the general name of Moors is applied, are perhaps of mixed descent, native and foreign. From the latitude stated to the Cape Colony, tribes commonly classed together under the title of the Ethiopic or Negro family are found, though many depart very widely from the peculiar physiognomy of the Negro, which is most apparent in the natives of the Guinea coast. In the Cape Colony, and on its borders, the Hottentots form a distinct variety in the population of Africa, most closely resembling the Mongolian races of Asia.

The Copts, or as they are correctly pronounced, either Ckoobt or Ckibt, are considered to be the descendants of the ancient Egyptians. They do not now compose more than one-sixteenth part of the population of Egypt, their number not exceeding 145,000, about 10,000 of whom reside at Cairo.

The countries above Egypt are inhabited by two tribes of people resembling each other in physical characters, but of distinct language and origin. One is, perhaps, the aboriginal or native, the other a foreign tribe.

The country of the Nubians is limited on the west by that of the Tibbus, who are spread over the eastern portions of the Sahara, as far as Fezzan and Lake Chad.

"All that is not Arabic in the kingdom of Morocco, all that is not Arabic in the French provinces of Algeria, and all that is not Arabic in Tunis, Tripoli, and Fezzan, is Berber. The language, also, of the ancient Cyrenaica, indeed the whole country bordering the Mediterranean, between Tripoli and Egypt, is Berber. The extinct language of the Canary Isles was Berber; and, finally, the language of the Sahara is Berber. The Berber languages, in their present geographical localities, are essentially inland languages. As a general rule, the

Arabic is the language for the whole of the sea-coast from the Delta of the Nile to the Straits of Gibraltar, and from the Straits of Gibraltar to the mouth of the Senegal." The Berber nation is one of great antiquity, and from the times of the earliest history has been spread over the same extent of country as at present; the ancient Numidian and Mauritanian names of Sallust, and other writers, have a meaning in the modern Berber.

The Shuluh, who are the mountaineers of the Northern Atlas, live in villages of houses made of stone and mud, with slate roofs, occasionally in tents, and even in caves. They are chiefly huntsmen, but cultivate the ground and rear bees. They are described as lively, intelligent, well-formed, athletic men, not tall, without marked features, and with light complexions. The Kabyles, or Kabaily, of the Algerian and Tunisian territories, are the most industrious inhabitants of the Barbary States, and, besides tillage, work the mines contained in their mountains, and obtain lead, iron, and copper.

The Tuarick are a people spread in various tribes through the greater portion of the Sahara.

The Moors who inhabit large portions of the empire of Morocco, and are spread all along the Mediterranean coast, are a mixed race, grafted upon the ancient Mauritanian stock; whence their name.

At two different periods, separated from each other by perhaps a thousand years, Africa was invaded by Arabic tribes, which took a lasting possession of the districts they conquered, and whose descendants form no inconsiderable portion of the population of North and Central Africa, while their language has superseded all others as that of civilisation and religion. Of the first invasion more has been said under the head "Abyssinians." The second was that effected by the first successors of Mahomet, who conquered Egypt, and subsequently the whole north of Africa as far as the shores of the Atlantic, in the course of the first century of the Hegira, or the seventh of the Christian era. As regards language, Egypt is now an entirely Arabic country, although in many other respects the Fellahs are totally different from the peasants in Arabia. But there are also several tribes of true Arabic descent scattered about from the high lands of Abyssinia down over Nubia and Egypt, and westward over the central provinces of Kordofan, Darfur, Waday, and Bornu. Others wander in the Libyan deserts and the Great Sahara, as well as in the states of Tripoli, Tunis, and Algiers, leading a similar life with the Kabyles, but constituting a totally distinct race. Others, again, dwell in the empire of Morocco, among whom those along the shores of the Atlantic are notorious for their predatory habits and ferocious character.

The early settlements of the Jews in Egypt are facts universally known. Under the Ptolemies, large numbers of them settled at Alexandria and in Cyrenaica, and after the destruction of Jerusalem they rapidly spread over the whole of the Roman possessions in Africa; many also took refuge in Abyssinia. King Philip II. having driven them out of Spain, many thousands of families took refuge on the opposite coast of Africa. They are now numerous in all the larger towns in the north, where they carry on the occupation of merchants, brokers, &c., the trade with Europe being mostly in their hands. They live in a state of great degradation, except in Algiers, where the French restored them to freedom and independence. They have acquired much wealth, and although compelled to hide their riches from the cupidity of their rulers, they lose no opportunity of showing them whenever they can do so without risk of being plundered, fear and vanity being characteristic features of their character. The Jewesses in Morocco and Algiers are of remarkable beauty.

Ever since the conquest of Egypt by Sultan Selim, and the establishment of Turkish pashalics in Tripoli, Tunis, and Algiers, Turks have settled in the north of Africa; and as they were the rulers of the country, whose numbers were always on the increase on account of the incessant arrivals of Turkish soldiers and officials, the Turkish became, and still is, the language of the different governments.

Not all the inhabitants of the country called Abyssinia are Abyssinians; nor are the real Abyssinians all of the same origin, being a mixed race, to the formation of which several distinct nations have contributed. The primitive stock is of Ethiopian origin, but, as their language clearly shows, was at an early period mixed with a tribe of the Himyarites from the opposite coast of Arabia, who, in their turn, were ethnologically much more closely connected with the Hebrews than with the Jectanides, or the Arabs properly speaking. In the age of the Egyptian Ptolemies, and after the destruction of Jerusalem, Jews settled in Abyssinia in such numbers, that not only their religion spread among the inhabitants, but the Hebrew language became mixed with the Abyssinian as it then was. Hence the surprising analogy between the principal Abyssinian languages, viz., the Gheez in Tigré, and the Amharic in Amhara, with the Hebrew.

The Ethiopic race comprehends by far the greater number of African nations, extending over the whole of Middle and South Africa except its southernmost projection towards the Cape of Good Hope. A line drawn from the mouth of the Senegal in the west to Cape Jeddaffin in the east, forms its northern limits almost with geometrical accuracy, few Ethiopic tribes being found to the north of it. All the members of this race, however, are not Negroes. The latter are only one of its numerous offshoots; but between the receding forehead, the projecting cheek-bones, the thick lips of the Negro of Guinea, and the more straight configuration of the head of a Galla in Abyssinia, there are still many striking analogies; and modern philology having traced still greater analogies, denoting a common origin, among the only apparently disconnected languages of so many thousands of tribes, whose color presents all the hues between the deepest black and the yellow brown, it is no longer doubtful that the Negro, the Galla, the Somali, and the Kaffre, all belong to the same ethnological stock.

The Kaffres, who, together with the tribes most akin to them, occupy the greater portion of South Africa, especially the eastern portions, have some analogy with Europeans in their features; but they are woolly haired, and while some are almost black, others are comparatively fair, although some of their tribes might have been mixed with the Eastern Negroes. They have been very wrongly classed with the Negroes.

We conclude this sketch with the Hottentot race, which is entirely different from all the other races of Africa. Where they originally came from, and how they happened to be hemmed in and confined entirely to this remote corner of the earth, is a problem not likely to be ever satisfactorily solved. The only people to whom the Hottentot has been thought to bear a resemblance are the Chinese or Malays, or their original stock, the Mongols. Like these people, they have the broad forehead, the high cheek-bones, the oblique eye, the thin beard, and the dull yellow tint of complexion, resembling the color of a dried tobacco leaf; but there is a difference with regard to the hair which grows in small tufts, harsh, and rather wiry, covering the scalp somewhat like the hard pellets of a shoe-brush.

In the central forest regions of Africa, wherever communications with the coast-land have been opened up,

hunting the elephant for its tusks to barter with the traders appears to be the characteristic occupation, if any beyond that of mere attention to the daily wants of life is engaged in; and here the population may be considered as a settled one, living in villages in the more open spaces of the woods. A rudely agricultural state seems to mark the outer belt of negro land on each side of the equatorial zone, where the population is also more or less stationary. The arid regions of the Sahara and the Kalahari beyond have, on the other hand, a thinly-scattered nomadic population, though here also the fertile wadis form lines of more permanent habitation, and contain permanent towns and villages.

Agriculture is conducted with little art. The natural fertility of the soil in the well-watered districts supercedes the need of skill, while the production of the simplest manufactures is alone requisite, where the range of personal wants embraces few objects, and those of the humblest class.

Wars, cruel and incessant, waged not for the sake of territory, but for the capture of slaves, form one of the most marked and deplorable features in the social condition of the African races.

In Religion, Christianity is professed in Abyssinia, and in Egypt by the Copts, but its doctrines and precepts are little understood and obeyed. Mohammedanism prevails in all Northern Africa, excepting Abyssinia, as far as a line passing through the Soudan, from the Gambia on the west to the confluence of the Quorra and Benue, and thence eastward, generally following the 10th parallel of N. lat. to the Nile below the junction of the Ghazal; thence southeast, leaving the coast-land in the Mohammedan region, to Cape Delgado. In Morocco, Algeria, and Egypt, there is an admixture of Jews. Heathen Negroes and Caffre tribes extend southward over the continent from the line described above to the colonies in the southern extremity of the continent; and over this vast area the native mind is surrendered to superstitions of infinite number and character. In the Cape Colony Protestantism again prevails, but with a strong intermixture of heathenism. The labors of Christian missionaries have, however, done much, especially in South Africa, toward turning the benighted Africans from idols to the living God.

In describing the political divisions of Africa, we shall proceed from north to south.

The country included under the general name of Barbary extends from the borders of Egypt on the east to the Atlantic on the west, and is bounded by the Mediterranean on the north, and by the Sahara on the south. It comprises the states of Morocco, Algeria, Tunis, and Tripoli.

The population consists chiefly of Mohammedan Moors and Arabs; the number of Jews is estimated at 60,000, and of Roman Catholics 75,000. The former have attained a higher degree of industry and civilisation than their brethren elsewhere; those of the latter who inhabit the central mountainous regions are nearly independent.

The government is vested in a hereditary bey, and has been conducted in peace and security for a number of years. From the year 1575 onwards, Tunis has been under the rule of Turkey; but by a firman of October 1871 the Sultan renounced the ancient tribute. The bey, who is styled "Possessor of the kingdom of Tunis," is confirmed in his position at Constantinople, and may neither enter into a war, nor conclude a treaty of peace, nor cede any part of his territory, without the sanction of the Sultan. The Tunisian coinage bears the name of the Sultan, and the troops (3900 infantry and artillery, and 100 cavalry, form the regular army) are at the disposal of the Sublime Porte in time of war. In the in-

terior of the country the bey has absolute power. The slave trade was abolished in 1842.

The commerce of Tunis is considerable, but agriculture is in a backward state. The exports consist chiefly of wool, olive-oil, wax, honey, hides, dates, grain, coral, &c.

The principal town is Tunis, situated on a shallow lake on the north coast. It is the most important commercial place on the southern shores of the Mediterranean after Alexandria, and had a population in 1901 of 170,000. The site of the ancient Carthage is 13 miles from Tunis in the direction of Cape Bon.

Tripoli, a regency of the Turkish empire, extends from Tunis along the shores of the Mediterranean to the table-land of Barca, which forms a separate province.

Tripoli is the capital of the regency, and the largest town; it lies on the Mediterranean, surrounded by a fertile plain; the number of inhabitants is about 30,000. Murzuk, the capital of Fezzan, has a mixed population of about 11,000 souls. The town of Ghadamis has about 7000 inhabitants.

Egypt occupies the north-eastern corner of Africa, and is remarkable for its ancient and sacred associations, and its wonderful monuments of human art.

Egypt is a vast desert, the fertile portions susceptible of cultivation being confined to the Delta of the Nile and its narrow valley, a region celebrated in the most ancient historic documents, for its singular fertility, and still pouring an annual surplus of grain into the markets of Europe. By the annual inundation of the Nile this region is laid under water, and upon its retirement the grain crops are sown in the layer of mud left behind it. Barren ranges of hills and elevated tracts occupy the land on both sides of the Nile, which is the only river of the country.

The climate is very hot and dry. Rain falls but seldom along the coasts, but the dews are very copious. The hot and oppressive winds, called khamsin and simooms, are a frequent scourge to the country; but the climate is, upon the whole, more salubrious than that of many other tropical countries.

The natural products are not of great variety. The wild plants are but few and scanty, while those cultivated include all the more important kinds adapted to tropical countries; rice, wheat, sugar, cotton, indigo, are cultivated for export; dates, figs, pomegranates, lemons, and olives, are likewise grown. The doum-palm, which appears in Upper Egypt, is characteristic, as also the papyrus. The fauna is characterised by an immense number of waterfowl, flamingoes, pelicans, &c. The hippopotamus and crocodile, the two primeval inhabitants of the Nile, seem to be banished from the Delta, the latter being still seen in Upper Egypt. The cattle are of excellent breed. Large beasts of prey are wanting; but the ichneumon of the ancients still exists. Bees, silk-worms, and corals are noticeable. Minerals are scarce, natron, salt, and sulphur being the principal.

The native Egyptians of Arab descent compose the great bulk of the people, the peasant and laboring class, and are termed Fellahs. Next in number, though comparatively few (145,000), are the Copts, descended from the old inhabitants of the country, the ancient Egyptians, but far from being an unmixed race. The Arabic Bedouin tribes, Negroes, European Christians (Greeks, Italians, French, Austrian, English), the Jews, and the dominant Turks, compose the remainder of the population.

Egypt at present is practically a British protectorate, though nominally governed by an hereditary prince called the Khedive. The Khedive, before British interference, was an absolute, unquestioned despot.

The agriculture of Egypt has always been considerable, there being three harvests in the year. The industry is

limited: one peculiar branch is the artificial hatching of eggs in ovens heated to the requisite temperature, a process which has been handed down from antiquity, and is now chiefly carried on by the Copts. Floating bee-hives are also peculiar to the Nile. The commerce is extensive and important: the exports to Europe consist chiefly of cotton, flax, indigo, gum-arabic, ostrich feathers, ivory, senna, and gold. The country forms part of the great highway of traffic between Europe and Southern Asia. Railways, from the ports of Alexandria and Damietta in the Mediterranean, and from Suez on the Red Sea, unite at Cairo; and a railway now extends thence up the bank of the Nile to near the first cataract of the river at Assouan, in lat. 24° N.

The Suez canal, uniting the Red Sea and the Mediterranean, was begun in April 1859, and was opened for traffic ten years later, in November 1869. The cutting runs from the artificial harbor of Port Said on the Mediterranean, through the shallow lagoon of Menzaleh, and through two smaller lakes with low sandhills between; nearer Suez a depressed area, in which several salt lakes formerly existed, has been filled up by water let in by the canal, and now forms a wide expanse of water. In length the canal is nearly 100 miles, and has a depth throughout of 26 feet, with a general width of 200 to 300 feet at the top of the banks and 72 feet at the bottom. Vessels are able to steam or be towed through the canal in sixteen hours from sea to sea.

Egypt proper is divided into three sub-pashalics — Bahari or Lower Egypt, Vostani or Middle Egypt, and Said or Upper Egypt. Cairo, on the east bank of the Nile, is the capital of Egypt, and is the largest town of Africa, containing 570,000 inhabitants: it has 400 mosques, and upward of 130 minarets, some of them of rich and graceful architecture, presenting at a distance an appearance singularly imposing. Alexandria on the coast, is the emporium of the commerce with Europe, and has 320,000 inhabitants, among whom are 46,113 Europeans. Damietta has a population of 43,751; Rosetta of 18,300. Suez, on the northern extremity of the Red Sea, is a small, ill-built town, but has assumed importance as a good port since the establishment of the overland route to India and the completion of the maritime canal. It has now nearly 24,970 inhabitants, of whom about 2,775 are Europeans. Port Said has 50,179 inhabitants, of whom one-half are foreigners.

Nubia extends along the Red Sea, from Egypt to Abyssinia, comprising the middle course of the Nile.

The natural features of the country are varied; the northern portion consisting of a burning, sterile wilderness, while the southern, lying within the range of the tropical rains, and watered by the Abyssinian affluent of the Nile, exhibits vegetation in its tropical glory, forests of arborescent grasses, timber-trees, and parasitical plants largely clothing the country. This latter territory, which may be called Upper Nubia, includes the region of ancient Meroe, situated in the peninsula formed by the Nile proper, the Blue River, and the Atbara, and comprises, further south, the recently extinguished modern kingdom of Sennar.

The climate of Nubia is tropical throughout, and the heat in the deserts of its central portions is not exceeded by that of any other part of the globe.

In the inhabitants two principal varieties are recognized, the pure original population, and their descendants, mixed with other nations. The Berberines inhabit the northern part, and the Bisharis the desert regions; the latter are the genuine Nubians, finely moulded and dark complexioned, supposed by some to agree more closely with the ancient Egyptians than the Copts, usually deemed their representatives. In the south-eastern part the true Negro element appears.

The country is favorable for agriculture, which, however, is only carried on to a limited extent, by the women. Cattle are abundant, and the camels of the Bisharin and Ababde are famous for their enduring powers. Salt is largely exported from the shores of the Red Sea to India, and ivory, with other products of tropical Africa, forms a principal article of trade.

Khartum, the capital of Nubia, the chief seat of commerce, contains a population variously estimated at from 20,000 to 50,000. It is a modern town, having been founded in 1821, and lies in a dry, flat and unhealthy country, near the confluence of the two main branches of the Nile.

Kordofan, on the western side of Nubia, lies between the parallels of 12° and 16° , and between the meridians 29° and 32° , containing about 30,000 square miles. It is a flat country, interspersed with a few hills, presenting in the dry season a desert with little appearance of vegetation, and in the rainy season a prairie, covered with luxuriant grass and other plants.

The population consists of Negroes. This country was, simultaneously with Nubia, made tributary to Egypt. The commerce consists of gum-arabic, ivory, and gold, and is not inconsiderable. El Obeid, the chief town, is composed of several villages of mud-built houses, thatched with straw, containing about 12,000 inhabitants.

The Saharan countries extend from the Atlantic in the west, to the Nilotic countries in the east, from the Barbary States in the north, to the basins of the Rivers Senegal and Kawara, and Lake Chad in the south. The area of this large space amounts to at least 2,000,000 square miles, or upwards of one-half of that of the whole of Europe. It is very scantily populated, but from our present defective knowledge of that region, the number of its inhabitants can be but roughly estimated.

The habitable portions of the Sahara are possessed by three different nations. In the extreme western portion are Moors and Arabs. They live in tents, which they remove from one place to another; and their residences consist of similar encampments, formed of from twenty to a hundred of such tents, where they are governed by a sheik of their own body; each encampment constituting, as it were, a particular tribe. They are a daring set of people, and not restrained by any scruple in plundering, ill-treating, and even killing persons who are not of their own faith; but to such as are, they are hospitable and benevolent. The boldest of these children of the desert are the Tuaricks, who occupy the middle of the wilderness, where it is widest.

The commerce of the Sahara consists chiefly of gold, ostrich feathers, slaves, ivory, iron, and salt, exchanged for manufactured goods, and transported across the desert by great caravans, which follow lines uniting the greater cities and oases of the southern and northern borders.

Western Africa comprehends the west coast of Africa, from the borders of the Sahara, in about lat. 17° N. to Nourse River, in about the same latitude south, with a considerable space of inland territory, varying in its extent from the shores, and, in fact, completely undefined in its interior limits.

Senegambia, the country of the Senegal and Gambia, extends from the Sahara in the north to lat. 10° in the south, and may be considered as extending inland to the sources of the waters which flow through it to the Atlantic.

The western portion is very flat, and its contiguity to the great desert is frequently evidenced by dry hot winds, an atmosphere loaded with fine sand, and clouds of locusts. The eastern portion is occupied with hills and elevated land.

The vegetation is most luxuriant and vigorous. The baobab (monkey bread-tree), the most enormous tree on the face of the globe, is eminently characteristic of Senegambia.

The inhabitants consist of various Negro nations, the chief of which are the Wolof.

The gum trade is the most important traffic on the Senegal; bees-wax, ivory, bark and hides forming the chief exports from the Gambia.

Of European settlements are: The French possessions on the Senegal; the capital of which is St. Louis, built about the year 1626, on an island at the mouth of the river. The total population of the settlement amounts to about 210,000.

The British settlement on the Gambia has about 7000 inhabitants. Bathurst is the chief town.

The Portuguese settlement consists of small factories south of the Gambia, at the Bissagos Islands, Bissao, Cacheo, and some other points.

The west coast of Africa, from Senegambia to the Nourse River, is commonly comprised by the general denomination Guinea Coast, a term of Portuguese origin.

The climate, notoriously fatal to European life, is rendered pestilential by the muddy creeks and inlets, the putrid swamps, and the mangrove jungles that cover the banks of the rivers. There are two seasons in the year, the rainy and the dry season. The former commences in the southern portion in March, but at Sierra Leone and other northern parts, a month later.

Vegetation is exceedingly luxuriant and varied. One of the most important trees is the *Elaeis guineensis*, a species of palm, from the covering of whose seed or nut is extracted the palm-oil, so well known to English commerce and manufacture. The palm-oil tree is indigenous and abundant from the river Gambia to the Congo; but the oil is manufactured in large quantities chiefly in the country of the Gold and Slave Coasts. The former comprises nearly all the more remarkable of African animals: particularly abundant are elephants, hippopotami, monkeys, lions, leopards, crocodiles, serpents, parrots. The domestic animals are mostly of an inferior quality. The principal minerals are gold and iron. The population consists, besides a few European colonists, of a vast variety of Negro nations, similar in their physical qualities and prevailing customs, but differing considerably in their dispositions and morals.

The chief articles of commerce are palm-oil, ivory, gold, wax, various kinds of timber, spices, gums, and rice.

The divisions of Northern or Upper Guinea are mostly founded on the productions characteristic of the different parts, and are still popularly retained.

The British colony of Sierra Leone extends from Rokelle river in the north, to Kater river in the south, and about twenty miles inland.

The Malaghetta or Grain Coast extends from Sierra Leone to Cape Palmas. Malaghetta is a species of pepper yielded by a parasitical plant of this region. It is sometimes styled the Windy or Windward Coast, from the frequency of short but furious tornadoes throughout the year.

The Ivory Coast extends from Cape Palmas 3° W. long., and obtained its name from the quantity of the article supplied by its numerous elephants.

The Gold Coast stretches from west of Cape Three Points to the river Volta, and has long been frequented for gold dust and other products. By a treaty of February 1871, the whole of the Dutch possessions on the Gold Coast were made over to Britain, and the Danish settlements of Christiansburg and Friedensburg were

ceded to the English in 1849; so that the British coast now extends from the mouth of the Tenda river, in long. $2^{\circ} 40'$ W., to that of the Ewe, in long. $1^{\circ} 10'$ E. of Greenwich.

The Slave Coast extends from the river Volta to the Calabar river, and is, as its name implies, the chief scene of the most disgraceful traffic that biots the history of mankind.

The kingdoms of Ashantee, Dahomey, Yoruba, and others, occupy the interior country of the Guinea coast.

On the Gaboon river, close to the equator, are a French settlement (in 1871 the French retained only a coaling station) and American missionary stations. At the equator Southern or Lower Guinea begins, where the only European settlements are those of the Portuguese.

Loango is reckoned from the equator to the Zaïre or Congo river. Its chief town is Boally, called Loango by the Europeans.

Congo extends south of the Zaïre, comprising a very fertile region, with veins of copper and iron. Banza Congo or St. Salvador is the capital.

Angola comprises the districts of Angola proper, Benguela, and Mossamedes. In these regions the Portuguese settlements extend farther inland than the two preceding districts, namely, about 200 miles. The capital, St. Paulo de Loando, contains 12,300 inhabitants, and has a fine harbor. St. Felipe de Benguela is situated in a picturesque but very marshy and most unhealthy spot.

The coast from Benguela to the Cape Colony may, in a general arrangement like this, be included either within West Africa or South Africa.

Under South Africa the Cape Colony only is generally comprised. It takes its name from the Cape of Good Hope, and extends from thence to the Orange river in the north, and to the Kai river in the east.

Apart from the shores, the country consists of high lands, forming parallel mountainous ridges, with elevated plains or terraces of varying extent between.

The high plains or terraces are remarkable for their extraordinary change of aspect in the succession of the seasons. During the summer heats they are perfect deserts, answering to the term applied to them, *karroos*, signifying, in the Hottentot language, "dry" or "arid." But the sandy soil being pervaded with the roots and fibres of various plants, is spontaneously clothed with the richest verdure after the rains, and becomes transformed for a time into a vast garden of gorgeous flowers, yielding the most fragrant odors. A great deposit of rich copper ore occurs near the mouth of the Orange; and salt is obtained for consumption and sale from salt lakes.

The climate is exceedingly fine and salubrious. There are two seasons, characterised by the prevalence of certain winds. During the summer, which lasts from September to April, the winds blow from south-east, cold and dry; during the winter, namely from May to September, north-west winds prevail. In the most elevated regions the winters are occasionally severe, and snow and ice occur.

The chief native tribes within the British territory are the Hottentots, Bechuanas, and Kaffres. No manufacture is conducted at the Cape except the making of wine, of which from 10,000 to 40,000 gallons are annually exported to England. Various articles of provision are supplied to ships sailing between Europe and the East Indies.

Cape Town is the capital of the colony, and contains 83,718 inhabitants, of whom 36,000 are Europeans. Its commerce is considerable, and the port is frequented by 500 to 600 vessels every year.

The Orange River Colony, added to the British

territories in 1848, but subsequently given up, though in 1901 re-occupied, extends north of the Orange River as far as the Ky Gariep or Vaal river. In consequence of the discovery of rich diamond fields on the lower Vaal river and in the neighboring territory of the Griqua chief Waterboer, who also petitioned to have his lands subjected to British rule, a wide country surrounding the diamond-fields was incorporated with the Cape Colony in October 1871, under the name of Griqua Land West, divided into the districts of Pnail, Griqua Town, and Klipdrift. The population of this new territory was estimated at 80,000 in 1901, concentrated in camps round the chief diamond-fields.

Natal or Victoria, a district on the east coast, and separated from the Capé Colony by Kaffraria, is a recently formed British settlement, which was created into a colony in 1856.

The Transvaal Colony is an inland country, between the Vaal on the south and the Limpopo river on the north, having the Drakenberg edge on the east, and the Bechuana tribes, which occupy the region bordering on the Kalahira desert, on the west, founded by the Dutch *boers* emigrating from the Cape Colony.

East Africa extends from Natal northward to the Red Sea, comprising Sofala, Mozambique, Zanzibar, and the Somali country.

Mozambique extends from the Zambeze to Cape Delgado, and is similar in its natural features, to the Sofala Coast. The greatest river is the Zambeze.

The Zanzibar or Sawahili Coast extends from Cape Delgado to the river Jub, near the equator. The coast is generally low, and has but few bays or harbors: its northern portion is rendered dangerous by a line of coral reefs extending along it. The vegetation is luxuriant, and cocoa-nut, palms, maize, rice, and olives are the chief articles of cultivation. The fauna comprises all the more characteristic African species.

The chief inhabitants are the Sawahili, of mixed Arab and Negro descent, but the coasts are under the Arab dominion of the Imaum of Muscat, by whose efforts commerce with the nations of the interior has greatly increased.

The Somali country comprises the eastern horn of Africa, from the equator northward to the Bay of Tadjura, near the entrance into the Red Sea.

The Somali country is famous for its aromatic productions and gums of various kinds; and it is supposed that the spices and incense consumed in such large quantities by the ancient peoples of Egypt, Greece, Syria, and Rome, were derived from this part of Africa, and not from Arabia.

Zeila and Berbera, on the northern coast, are the chief trading ports: the permanent population of the former is about 3000, while the latter may be said to exist only during the winter, when no less than 20,000 strangers, at an average, arrive to pitch their tents, and thus create a great market-place.

Central Africa comprises the regions which extend from the southern borders of the Sahara in the north to Cape Colony in the south, and from Senegambia in the west to the territory of the Egyptian pashalic on the east. It comprehends the central basins of the great lakes from Lake Chad to the Nyassa, and the greater part of the basins of the Niger, Congo, Nile, and Zambeze. Even the Sahara may well be included in this general denomination.

Timbuktu, or Jennie, comprises the basin of the Joliba below Bambarra, and lies partly within the Great Sahara. Timbuktu, a few miles from the banks of the Joliba, and situated amid sands and deserts, is a celebrated centre of the North African caravan trade. It contains from 12,000 to 15,000 inhabitants.

Houssa is an extensive country extending to the Sahara in the north, to the Joliba or Kawara on the west, to Bornu on the east, and to about 10° N. lat. on the south.

The capital, Sakatu, is one of the largest cities in Negroland; it is situated in a fertile but marshy plain. Kano, another large town, containing 30,000 to 40,000 inhabitants, is the great emporium of trade in Houssa; there the English merchandise coming from the north through the Sahara, meets with American goods coming from the Bight of Benin.

Bornu is one of the most powerful states of Negroland, extending on the west to the 10th degree of long., on the east to Lake Chad and the kingdom of Baghermi, and on the south as far as Mandara and Adamaua, in about 11° N. lat.

The general character of Bornu is that of a plain, subject to inundations, particularly near Lake Chad. It is very fertile, and cotton and indigo attain a high degree of excellence. The original Bornuese are an agricultural people.

Kuka, the capital and residence of the Sheik of Bornu, had in 1866 about 60,000 inhabitants.

Baghermi, another powerful kingdom, is situated east of Bornu. The boundaries, according to Dr. Barth, who first visited this country and penetrated as far as Maseña, the capital, are on the west the river Loggema, a tributary of the Shary or Asu, by which it is divided from Bornu and Adamaua; on the north its limits are in about $12\frac{1}{2}^{\circ}$ N. lat., and on the east $19\frac{1}{2}^{\circ}$ E. long., both lines dividing it from Waday; the southern boundary is in about $8\frac{1}{2}^{\circ}$ N. lat. Baghermi is an extensive plain or valley formed by the river Shary or Asu and its tributaries.

Waday, or Dar Saley, lies east of Baghermi, and reaches as far as Darfur. It comprises an extensive region, stretching as far as the basin of the Nile.

Darfur, east of Waday, extends as far as Kordofan. The country rises towards the west into a range of hills called Jebel Marrah. It is drained into the Nile. A great portion of the country is Saharan in its character, while other parts are fertile and diversified. Browne, in 1703, estimated the whole population at 200,000. It has an extensive trade with Egypt.

Cobbeih, the capital, is a merchant town, and contains about 6000 inhabitants.

Fumbina or Adamaua is an extensive country south of Houssa and Bornu, under Foulah dominion. It consists of a large, fertile, and highly-cultivated valley, formed by the river Benue. Near Yola, the capital, the Benue receives the Faro, a large tributary coming from the south-west. This country was first visited by Dr. Barth in 1851.

Yola, the capital, lies in $8^{\circ} 50'$ N. lat., and $13^{\circ} 30'$ E. longitude.

To Africa belong a considerable number of islands. The Madeiras, belonging to Portugal, lie off the North-west coast of Africa, at a distance of about 360 miles. Madeira, the chief island, is about 100 miles in circuit, and has long been famed for its picturesque beauty, rich fruits, and fine climate, which renders it a favorite resort of invalids. Wine is the staple produce. Funchal, the chief town, with 24,000 inhabitants, is a regular station for the West India mail steam-packets from Southampton, and the Brazilian sailing-packets from Falmouth.

The Canaries, belonging to Spain, the supposed Fortunate Islands of the ancients, are situated about 300 miles south of Madeira. They are 13 in number, all of volcanic origin, Teneriffe being the largest.

The Cape Verde Islands, subject to Portugal, are a numerous group about 80 miles from Cape Verde.

Fernando Po, a very mountainous forest-covered

island, is in the Bight of Biafra. The British settlement of Clarence Town was established in 1827, but afterwards abandoned. The island now belongs to Spain.

St. Thomas, immediately under the equator, is a Portuguese settlement; as is also Prince's Island, in 2° N. lat.

Annobon in 2° S. lat., belongs to the Spaniards.

Ascension, a small, arid, volcanic islet, was made a British port on the arrival of Napoleon Bonaparte at St. Helena, and since retained as a station at which ships may touch for stores.

St. Helena is a huge dark mass of rock, rising abruptly from the ocean to the height of 2692 feet. James' Town is the only town and port.

Madagascar, the largest island of Africa, and one of the largest in the world, is separated from the Mozambique coast by a channel of that name, about 250 miles wide. The area exceeds that of France.

AFRICANUS, JULIUS, called also SEXTUS, a Christian historian of the 3d century, born, according to some, in Africa, and, according to others, in Palestine, of African parents. Little is known of his personal history, except that he lived at Emmaus, and that he went on an embassy to the emperor Heliogabalus to ask the restoration of that town, which had fallen into ruins. His mission succeeded, and Emmaus was henceforward known as Nicopolis. He wrote a history of the world from the creation to the year 221 A.D., a period, according to his computation, of 5723 years. He calculated the period between the creation and the birth of Christ as 5499 years, and antedated the latter event by three years. This method of reckoning became known as the Alexandrian era, and was adopted by almost all the eastern churches.

AFZELIUS, ADAM, an eminent Swedish naturalist, born at Larf, West Gothland, in 1750. For two years (1792-94) he resided on the west coast of Africa as botanist to the Sierra Leone Company. He edited the autobiography of Linnæus (Upsala, 1823). He died at Upsala in 1836, having bequeathed his botanical collection to the university.

AFZELIUS, ARWID AUGUST, the Swedish historian, poet, and comparative mythologist, was born at Fjell ker in 1785. His poetical career began in 1811 and closed in 1848, when he wrote his *Farewell to the Swedish Harp*. One great work of his life was to collect and publish, in conjunction with the eminent Geijer, three volumes of Swedish Folk-songs; but he will be best remembered by his *History of the Swedish People*, which has won him a European reputation. He did not bring this history lower down than 1709, dying in 1871.

AGA, or AGHA, a word, said to be of Tartar origin, signifying a dignitary or lord. Among the Turks it is applied to the chief of the janissaries, to the commanders of the artillery, cavalry, and infantry, and to the eunuchs in charge of the seraglio. It is also employed generally as a term of respect in addressing wealthy men of leisure, land-owners, &c. The word is found with a somewhat similar usage in Tartary, Persia, and Algiers.

AGADES, the capital of the kingdom of Air, or Asben, in Central Africa. The town is built on the edge of a plateau, 2500 feet above the level of the sea, and is supposed to have been founded by the Berbers to serve as a secure magazine for their extensive trade with the Songhay empire. The chief trade is in grain. Agades derives its main importance from its situation on the direct route from the countries to the north-east to Sokoto and other important towns in the Hansa states. The great salt caravans pass through it, as well as pilgrims on their way to Mecca. From its healthy climate and advantageous position, the place might prove to be a good station for a European agent.

AGAMEMNON. Agamemnon was a son of Atreus, his mother being Aërope; succeeded to the sovereignty of Atreus over Argolis, Corinth, Achaia, and many islands, his seat being at Mycenæ. The succession had been usurped by Thyestes and Ægisthus. During the usurpation Agamemnon and his brother Menelaus visited Tyndareus, the king of Sparta, and obtained in marriage his two daughters—the former Clytæmnestra, the latter Helena; with his help Agamemnon was reinstated in his rights. Menelaus succeeded Tyndareus. The children borne by Clytæmnestra were Chrysothemis, Iphigenia, Electra, and one son, Orestes. Agamemnon was then the most powerful prince in Greece; and to him of right, as well as naturally, his brother Menelaus turned for aid to compel the Trojans to give up his wife Helena, whom Paris had carried off. The various princes of Greece having been brought to unite in an expedition for this purpose, Agamemnon was chosen leader, he himself furnishing 100 ships and lending also 60 more to the Arcadians. He was defeated at the siege of Troy. In his absence Clytæmnestra had yielded to the temptations of Ægisthus, and, to cover her shame, planned with him the death of her husband. The approach of Agamemnon being announced by a spy, a feast and an affected welcome were prepared for him and his followers. At the feast they were fallen upon by hired murderers, assisted by Ægisthus and Clytæmnestra. According to Æschylus. Agamemnon was slain in his bath, his wife first throwing a piece of cloth over him to prevent resistance. For his death vengeance was taken by his son Orestes. In Sparta he was worshipped under the title of Zeus Agamemnon.

AGAMI, the common name of a genus of crane-like birds, better known as TRUMPETERS. See TRUMPET BIRD, page 5931.

AGAMIDÆ, a family of terrestrial lizards, closely related to the IGUANAS. See IGUANA, page 3351.

AGAMOGENISIS, reproduction without sex, a process of multiplication by division, budding, etc., in which there is no union of sexual elements.

AGAPE, plur. **AGAPÆ**, the love-feast, or feast of charity, which among the primitive Christians usually accompanied the Eucharist. The feelings of love and brotherhood fostered by the new faith, strengthened as these must have been by the complete isolation of the little Christian community, are quite sufficient to account for the existence of the Agapæ, without referring them to other more or less similar institutions. The Agape was a common feast, symbolising the community of goods when it no longer really existed, to which the rich brought provisions, and the poor, who brought nothing, were invited. At first it was observed probably every evening in immediate connection with the celebration of the Lord's Supper. It closed with the holy kiss.

AGAPETUS, deacon of the St. Sophia Church at Constantinople, presented to the Emperor Justinian a work entitled *Charita Regia*, composed in 527, which contained advice on the duties of a Christian prince.

AGAR, a town of Gwalior, India, 41 miles north-east of Ujain, with a population (1890) of 30,000.

AGARDE, ARTHUR, a learned English antiquary, born at Foston, in Derbyshire, about 1540. He was trained a lawyer; but entering the exchequer as a clerk, he became deputy-chamberlain in 1570. This office he held for forty-five years. Agarde died in 1615, and was buried in the cloister of Westminster Abbey.

AGARDH, KARL ADOLPH, born in Sweden, January 23, 1785; studied at Lund, where in 1812 he became professor of botany. He wrote extensively on the *algæ*, subsequently took orders, and died a bishop in 1859.

AGARDH, JACOB GEORG, son of the foregoing,

was born at Lund, Sweden, in 1813; succeeded his father as professor of botany there, 1854-79, and wrote many important works on the *algæ*.

AGASIAS, son of Dositheus, a famous sculptor of Ephesus, who is supposed to have lived about the fourth century. His celebrated work, known erroneously as the *Borghese Gladiator*, was discovered at the commencement of the thirteenth century in the ruins of an Imperial palace at Antium, where the *Apollo Belvidere* was also found.

AGASSIZ, LOUIS JOHN RUDOLPH, was the son of a Swiss Protestant clergyman. Agassiz was born at Motiers on May 28, 1807. Educated first at home, then spending four years at the gymnasium of Bienne, he completed his elementary studies at the academy of Lausanne. He studied medicine successively at the universities of Zurich, Heidelberg, and Munich; at the same time availing himself of the advantages afforded by these universities for extending his knowledge of natural history, especially of botany. Having completed his academical course, he took his degree. Thus, in 1828, we find him, after describing a new species of *Cynocephalus*, publishing a description of a new cyprinoid fish. This was followed by a yet more elaborate research into the history of the cyprinoid and other fishes found in the lake of Neuchâtel. Rapidly enlarging his plans, the publication of the last-named work was succeeded by the issue, in 1830, of a prospectus of a *History of the Freshwater Fishes of Central Europe*. The task was completed and the work published in 1829.

Agassiz soon found that his palæontological labors rendered a new basis of ichthyological classification absolutely necessary. The fossils rarely exhibited any traces of the soft tissues of fishes. They chiefly consisted of the teeth, scales, and fins, even the bones being perfectly preserved in but comparatively few instances. Hence the classifications of Cuvier and other naturalists were of little use to him in determining the mutual relations of the fossil forms. He therefore adopted his well-known classification, which divided fishes into four groups—viz., Ganoids, Placoids, Cycloids, and Ctenoids.

Under twenty-five years of age, and, as already observed, with limited financial resources, he nevertheless seems to have known no fear. He soon announced to geologists several important generalisations, the correctness of which has been confirmed by all subsequent research. In particular, he pointed out that no examples of Cycloids and Ctenoids, comprehending the bulk of the fishes now seen in our markets, were to be found in rocks of older date than the cretaceous age.

As the work proceeded it became obvious that it would over-tax the resources of the intrepid young zoölogist, unless some additional assistance could be afforded to him. The British Association for the Advancement of Science wisely came to his aid, and the late Earl of Ellesmere—better known in his youth as Lord Francis Egerton—gave him yet more efficient help.

It was whilst he was thus engaged that Agassiz paid his first visit to England, for the purpose of studying the rich stores of fossil fishes with which this country abounds.

Subsequently to his first visit to England the labors of Hugh Miller, Dr. Malcolmson, and other geologists brought to light the marvellous ichthylal fauna of the Devonian beds of the north-east of Scotland.

The year 1840 witnessed the inauguration of a new movement, which has proved to be of the utmost importance to geological science. Previously to this date De Saussure, Venetz, Charpentier, and others had made the glaciers of the Alps the subjects of special study, and Charpentier had even arrived at the important conclusion that the well-known erratic blocks of alpine rocks scattered so abundantly over the slopes and summits of the

Jura mountains, had been conveyed thither by glaciers. The question having attracted the attention of Agassiz, he at once grappled with it in his wontedly enthusiastic manner. He not only made successive journeys to the alpine glaciers, but he had a rude hut constructed upon one of the Aar glaciers, which for a time he made his comfortless home, in order that he might the more thoroughly investigate the structure and movements of the ice. These labors resulted in the publication of his magnificent illustrated folio entitled *Etudes sur les Glaciers*. In this important work the movements of the glaciers, their moraines, their influence in grooving and rounding off the rocks over which they travelled, were treated with a comprehensiveness which threw into the shade all the writings of previous laborers in this field. He not only accepted Charpentier's idea that some of the alpine glaciers had extended across the wide plains and valleys drained by the Aar and the Rhone, and thus landed parts of their remains upon the uplands of the Jura, but he went still further in the same direction. He concluded that, at a period geologically recent, Switzerland had been another Greenland; that instead of a few glaciers stretching their restricted lines across the areas referred to, one vast sheet of ice, originating in the higher Alps, had extended over the entire valley of north-western Switzerland until it reached the southern slopes of the Jura, which, though they checked and deflected its further extension, did not prevent the ice from reaching in many places the summit of the range.

Thus familiarized with the phenomena attendant on the movements of recent glaciers, Agassiz was prepared for a new and most unexpected discovery which he made in 1846, in conjunction with the late Professor Buckland. These two *savants* visited the mountains of Scotland together, and found in six different localities clear evidence of some ancient glacial action. The discovery was announced to the Geological Society of London in a joint communication from the two distinguished observers. In the autumn of 1846 he crossed the Atlantic, with the two-fold design of investigating the natural history and geology of the United States, and delivering a course of lectures on zoölogy at the Lowell Institute; and the tempting advantages, pecuniary and scientific, presented to him in the New World, induced him to settle in the United States, where he remained to the end of his life. He was appointed professor of zoölogy and geology in the university of Cambridge, in 1847.

This transfer to a new field, and the association with fresh objects of high interest to him, gave his energies a new stimulus. Volume after volume now proceeded from his pen: some of his writings were popular, and addressed to the multitude, but most of them dealt with the higher departments of scientific research. But at length the great strain on his physical powers began to tell. He then sought to restore his waning health by a southern voyage. His early labors among the fishes of Brazil had often caused him to cast a longing glance towards that country; and he now resolved to combine the pursuit of health with the gratification of his long-cherished desires. In April 1865 he started for Brazil, along with his admirable wife and an excellent class of assistants. An interesting account of this journey, to the success of which the emperor of Brazil contributed in every possible way, was published by Mrs. Agassiz when they returned home, laden with the natural treasures of the Brazilian rivers.

In 1871 he made a second excursion, visiting the southern shores of the North American continent, both on its Atlantic and its Pacific seaboard. He had for many years yearned after the establishment of some permanent school where zoölogical science could be studied, not in class-rooms or museums of dead specimens, but

amidst the living haunts of the subjects of study. Like all truly great teachers, he had little faith in any school but that of nature. The last, and possibly the most permanently influential, of the labors of his long and successful life, was the establishment of such an institution, which he was enabled to effect through the liberality of Mr. John Anderson, a citizen of New York. That gentleman not only handed over to Agassiz the island of Penikese, on the east coast, but also presented him with \$50,000 wherewith permanently to endow it as a practical school of natural science, especially devoted to the study of Marine zoölogy. The disease with which he had struggled for some years proved fatal on December 14, 1873.

AGATE, a name applied by mineralogists to a stone of the quartz family, generally occurring in rounded nodules or in veins in trap rocks. The number of agate balls in the rock often give it the character of amygdaloid; and when such a rock is decomposed by the elements, the agates drop out, and are found in the beds of streams that descend from it; or they may be obtained in quarrying. The principal varieties are—

1. *Calcedony*. In this the colors are in parallel bands.

2. *Carnelian*, or red calcedony, when found is almost always brownish or muddy.

3. *Mocha stones*, originally brought from the East, are clear grayish calcedonies, with clouds and dashes of rich brown of various shades.

4. *Moss agates* are such as contain arborisations or *dendrites* of oxide of iron, some of which seem to be petrifications of real vegetable forms.

5. *Bloodstone* is a dark green agate containing bright red spots like blood-drops.

6. *Plasma*, a grass-green stone, found engraved in ruins at Rome, on the Schwartzwald, and on Mount Olympus, appears to be calcedony colored by chlorite.

7. *Chrysoprase*, found in Silesia, is an agate colored apple-green by oxide of nickel.

AGATHA, Sr., a noble Sicilian lady who suffered martyrdom during the persecution of the Christians under Decius, A. D. 251. Her festival falls on February 5.

AGATHARCHIDES, a celebrated Greek grammarian and geographer who flourished about 140 years B. C., was born at Cnidos.

AGATHARCHUS, a Greek painter. He flourished about 4th B. C.

AGATHIAS, a Greek historian and poet, born at Myrina in Asia Minor, about 536 A. D.

AGATHO, an Athenian tragic poet, the disciple of Prodicus and Socrates, celebrated by Plato in his *Protagoras* for his virtue and his beauty.

AGATHOCLES, a famous tyrant of Sicily, was the son of a potter at Rhegium. By his singular vigor and abilities he raised himself through various gradations of rank till he finally made himself tyrant of Syracuse, and then of nearly all Sicily. He died in the seventy-second year of his age, B. C. 290, after a reign of twenty-eight years.

AGAVE, a genus of plants of remarkable and beautiful appearance, belonging to the natural order of *Amaryllidæ*. There are a number of species, all natives of Mexico and Central America. The best known species is *Agave Americana*, which has been naturalized in Europe. The Mexican agave yields a sap from which the native drink, *aguardiente*, is distilled.

AGDE, a town of France, in the department of Hérault, on the left bank of the river by that name, 30 miles southwest of Montpellier. It is a place of great antiquity, and is said to have been founded, under the name of *Agathe*, by the Greeks. The place commands

an extensive coasting trade, more than 400 vessels annually entering the port. Soap and verdigris are manufactured, and the staple productions of southern France are largely exported. Population, 9747.

AGE, a term denoting generally any fixed period of time, is used more definitely in a variety of senses. Hesiod, for example, in his poem *Works and Days*, describes minutely five successive ages, during each of which the earth was peopled by an entirely distinct race. The first or *golden* race lived in perfect happiness on the fruits of the untilled earth, suffered from no bodily infirmity, passed away in a gentle sleep, and became after death guardian dæmons of this world. The second or *silver* race was degenerate, and, refusing to worship the immortal gods, was buried by Jove in the earth. The third or *brazen* race, still more degraded, was warlike and cruel, and perished at last by internal violence. The fourth or *heroic* race, was a marked advance upon the preceding, its members being the heroes or demigods who fought at Troy and Thebes, and who were rewarded after death by being permitted to reap thrice a year the free product of the earth. The fifth or *iron* race, to which the poet supposes himself to belong, is the most degenerate of all, sunk so low in every vice that any new change must be for the better.

A definite period in history distinguished by some special characteristic, such as great literary activity, is generally styled, with some appropriate epithet, an age. According to Fichte's scheme there are five ages, distinguished by the relative predominance which instinct, external authority, and reason have in them respectively, instinct being supreme in the first, and reason in the last. Comte's scheme distinguishes three ages according to the state of knowledge in each, and he supposes that we are now entering upon the third of these.

In relation to individual as well as to social life, age is used with a considerable variety of application. It frequently denotes the total duration of life in man, animals, or plants, and in this sense belongs to the subject of LONGEVITY (*q.v.*) It also denotes in man the various periods into which his life may be divided, either from a physiological or from a legal point of view. In the former aspect perhaps the most common division is into the four ages of infancy, youth, manhood, and old age. These again have been increased to six or seven by some physiologists—infancy, childhood, boyhood, or girlhood, adolescence, manhood or womanhood, age, and old age or second childhood. While both schemes have a sufficient basis of scientific accuracy, they have also each attracted the fancy of the poet. The division of human life into periods for legal purposes is naturally sharp and definite. It would be unscientific in the physiologist to name any precise year for the transition from one of his stages to another, inasmuch as that differs very considerably among different nations, and even to some extent among different individuals of the same nation. But the law must necessarily be fixed and uniform, and even where it professes to proceed according to nature, must be more precise than nature. In France the year of majority is twenty-one, and the nubile age, according to the *Code Napoleon*, eighteen for males and fifteen for females, with a restriction as to the consent of guardians. In Germany majority is usually reached at twenty-four, though in some states (Bavaria, Saxony, Würtemberg, and Baden) the age is twenty-one. In the United States the age qualification for a president is thirty-five, for a senator thirty, and for a representative twenty-five.

AGELADAS, an eminent statuary of Argos, and the instructor of the three great sculptors, Phidias, Myron, and Polycletus.

AGELNOTH, ÆTHELNOTH, or ETHELNOTH, known also as *Achelnotus*, son of Egelmær the Earl,

Archbishop of Canterbury in the reign of Canute, was trained in the monastery at Glastonbury, for which he afterward obtained new privileges from the king. According to William of Malmesbury, he exercised a great and salutary influence over Canute in the way both of encouragement and restraint. He was appointed dean of Canterbury and chaplain to the king, and was raised to the archbishopric on the death of Living in 1020. When Canute died, he made the archbishop promise to be faithful to his sons by Emma, and the promise was so truly kept that Harold, the usurper, remained unconsecrated until after the death of Agelnoth (1038).

AGEN, the chief town of the department of Lot-et-Garonne in France, is situated on the right bank of the Garonne, 73 miles southeast of Bordeaux. Pop. 22,000.

AGENT, in *Diplomacy, Commerce and Jurisprudence*, is a name applied generally to any person who acts for another. It has probably been adopted from France, as its function in modern civil law was otherwise expressed in Roman jurisprudence.

In *Diplomacy*, a class of semi-ambassadors termed agents have been employed generally between states of unequal power. The small community might send an agent to propitiate some powerful government, and secure its protection. A great power would, on the other hand, distribute its agents among the petty states which it kept in clientage, to see that no counteracting influence was at work among them. See AMBASSADOR ; DIPLOMACY.

The law of PRINCIPAL AND AGENT has its origin in the law of mandate among the Romans, and fortunately even in England the spirit of that system of jurisprudence pervades this branch of the law.

In a general view of the law of agency it is necessary to have regard to the rights and duties of the principal, the agent, and the public. The agent should not do what he has no authority for ; yet if he be seen to have authority, those with whom he deals should not be injured by secret and unusual conditions. The employer is bound by what his agent does in his name, but the public are not entitled to take advantage of obligations which are known to be unauthorized and unusual.

Agents are of different kinds, according to their stipulated or consuetudinary powers. The main restraint in the possible powers of an agent is in the old maxim, *delegatus non potest delegare*, designed to check the complexity that might be created by inquiries into repeatedly-deputed responsibility. The agent cannot delegate his commission to put another in his place ; but in practice this principle is sometimes modified, for it so may arise from the nature of his office that he is to employ other persons for the accomplishment of certain objects.

In the general case, agency is constituted by the acceptance of the mandate or authority to act for the principal, and the evidence of this may be either verbal or in writing. The English statute of frauds requires an agent to have authority in writing for the purposes of its 1st, 2d, and 3d clauses relating to leases. "And it is a general rule that an agent who has to execute a deed, or to take or give livery or seisin, must be appointed by deed for that purpose." Agency may also be either created or enlarged by *implication*. What the agent has done with his principal's consent the public are justified in believing him authorized to continue doing. The law is ever jealous in admitting as accessories of a general appointment to any particular agency the power to borrow money in the principal's name, to give his name to bill transactions and to pledge him to guaranties ; but all these acts may be authorized by implication ; or by being the continuation of a series of transactions of the same kind and in the same line of business, to which the principal has given his sanction

The obligations of the principal are — to pay the agent's remuneration, or, as it is often called, *commission*, the amount of which is fixed by contract or the usage of trade; to pay all advances made by the agent in the regular course of his employment; and to honor the obligations lawfully undertaken for him. The agent is responsible for the possession of the proper skill and means for carrying out the functions which he undertakes. He must devote to the interests of his employer such care and attention as a man of ordinary prudence bestows on his own — a duty capable of no more certain definition, the application of it as a fixed rule being the function of a jury. He is bound to observe the strictest good faith; and in some instances the law interposes to remove him from temptation to sacrifice his employer's interest to his own; thus, when he is employed to buy, he must not be the seller; and when employed to sell, he must not be the purchaser. He ought only to deal with persons in good credit, but he is not responsible for their absolute solvency unless he guarantee them. See ATTORNEY.

In France the *Agents de Change* were formerly the class generally licensed for conducting all negotiations, as they were termed, whether in commerce or the money market. Of late the term has been practically limited to those who conduct, like our stockbrokers, transactions in public stock; and it is understood that it is rather as speculators than as agents that the majority of them adopt the profession. The laws and regulations as to *courtiers*, or those whose functions were most distinctly confined to transactions in merchandise, have been mixed up with those applicable to *agents de change*. Among the other revolutionary measures of the year 1791, the professions of agent and *courtier* were again opened to the public.

AGGLOMERATE, or VOLCANIC AGGLOMERATE, is a rock made up of a confused mass of angular blocks of all sizes. It may consist exclusively of igneous rocks, or of sedimentary rocks, or of both.

AGESILAUS, king of the Lacedæmonians, the second of the name, son of Archidamus II., was, through the influence of Lysander, raised to the throne in 398 B.C., in opposition to the superior claim of his nephew Leotychides. Immediately on his accession he advised the Lacedæmonians to anticipate the king of Persia, who was making great preparations for war, and attack him in his own dominions. He was himself chosen for this expedition, and gained so many advantages over the enemy that, if the league which the Athenians and the Thebans formed against the Lacedæmonians had not obliged him to return home, it seems probable that he would have carried his victorious arms into the very heart of the Persian empire. But he readily gave up all these triumphs to come to the succor of his country, which he happily relieved by his victory over the allies at Chæronea, in Bœotia, 394 B.C. He obtained another near Corinth; but, to his great mortification, the Thebans afterwards gained several victories over the Lacedæmonians. He died in the third year of the 103d Olympiad, being the 84th year of his age and 38th of his reign, and was succeeded by his son Archidamus.

AGGREGATION, STATES OF, the three states — *solid*, *liquid* and *gaseous* — in which matter occurs, depending on the degree of cohesion that subsists between the molecules or atoms of material bodies. In the solid state, the molecules cohere so firmly that their relative positions cannot be changed without the application of force, and the body retains a definite form; in the liquid state, they move freely and readily on each other, the cohesion that exists being so slight that the body has itself no form; in the gaseous state, they are affected by an elastic force that amounts to repulsion, and so diffuse

them through an increased space. The metals, glass, wood, &c., are solids; water and atmospheric air are the most familiar types of liquid and gaseous bodies.

AGHRIM, or AUGHIRM, a small village in Galway, 4 miles W. of Ballinasloe, is rendered memorable by the decisive victory gained there on the 12th July, 1601, by the forces of William III., under General Ginkell, over those of James II., under the French general St. Ruth.

AGINCOURT, or AZINCOURT, a French village, in the department of Pas de Calais, situated in 50° 35' N. lat., 2° 10' E. long., famous on account of the victory obtained there by Henry V. of England over the French. Following the example of several of his predecessors, the young king crossed over to France in the third year of his reign on a military expedition. On the morning of Friday, the 25th of October, 1415, A.D., St. Crispin's day, the English and French armies were ranged in order of battle, each in three lines, with bodies of cavalry on both wings. The Constable d'Albert, who commanded the French army, fell into the snare that was laid for him, by drawing up his army in a narrow plain between two woods. The first line was commanded by the Constable d'Albert, the dukes of Orleans and Bourbon, and many other nobles; the dukes of Alençon, Brabant, and Barre conducted the second line; and the earls of Marle, Damartine, Fauconberg, &c., were at the head of the third line. The king of England placed 200 of his best archers in ambush in a low meadow on the flank of the first line of the French. His own first line consisted wholly of archers. The main body of the English army, consisting of men-at-arms, was commanded by Henry in person; the vanguard, committed to Edward Duke of York at his particular request, was posted as a wing to the right; and the rearguard, commanded by Lord Camois, as a wing on the left. The archers were placed between the wings, in the form of a wedge. The two armies, drawn up in this manner, stood a considerable time gazing at one another in silence. But the English king, dreading that the French would discover the danger of their situation and decline a battle, commanded the charge to be sounded, about 10 o'clock in the forenoon. At that instant the first line of the English kneeled down and kissed the ground; and then starting up, discharged a flight of arrows, which did great execution among the crowded ranks of the French. Immediately after, upon a signal being given, the archers in ambush arose, and, discharging their arrows on the flank of the French line, threw it into some disorder. The battle now became general, and raged with great fury. The English archers threw away their bows, and rushing forward, made dreadful havoc with their swords and battle-axes. The first line of the enemy was by these means defeated, its leaders being either killed or taken prisoners. The second line, commanded by the Duke d'Alençon, now advanced, and was met by the second line of the English, led by the king. The duke forced his way to the king, and assaulted him with great fury; but Henry brought him to the ground, where he was instantly dispatched by the surrounding soldiers, receiving innumerable wounds. Discouraged by this disaster, the second line made no more resistance, and the third fled without striking a blow; yielding a complete and glorious victory to the English, after a violent struggle of three hours' duration. The loss to the conquerors is generally reckoned at 1600 men, and the French are said to have left 10,000 slain on the field, including the constable, three dukes, five counts, and ninety barons.

AGIO (Ital. *aggio*, exchange, discount), a term used in commerce to denote the difference between the real and the nominal value of money. In some states the coinage is so debased, owing to the wear of circulation.

that the real is greatly reduced below the nominal value. In countries where silver coinage is the legal tender, agio is sometimes allowed for payment in the more convenient form of gold.

AGIS. Four kings of this name reigned at different periods in Sparta, the first of the name, it is supposed, about 1030 B.C. Agis II. succeeded his father, Archidamus, and reigned from 427 to 399 B.C. Agis III. succeeded his father Archidamus III., 338 B.C. Agis IV., son of Eudamidas II., and lineally descended from Agesilaus II., succeeded his father 244 B.C., and reigned four years. He was more distinguished for the social reforms he attempted to introduce at Sparta than for his success as a general. The degenerate state of the Spartan commonwealth led him to attempt a reformation by restoring the institutions of Lycurgus, and, in the spirit of a true reformer, he set the example in his own person and household. His excellent intentions were seconded by all the younger and poorer portion of the community; but the rich and luxurious were vehemently opposed to measures which threatened to interfere so seriously with their influence and pleasures. His colleague, Leonidas, headed the opposition, and busily propagated the suspicion that Agis aspired to tyranny, by obliterating the distinctions of society and increasing the power of the multitude. At this time the Achæans sent to Sparta for assistance in the war with the Ætolians, which was granted. Agis received the command of the troops, and though he gained no advantage over the cautious Aratus, the Achæan general, he conducted the campaign with considerable credit from the good discipline he maintained in his army. On his return he found that the misconduct of Agesilaus had resulted in a revolution and the recall of Leonidas. Leonidas contented himself with banishing his son-in-law, but resolved on the ruin of Agis. The unfortunate king was accordingly seized and cast into prison, where, after a mock trial, he was sentenced to be strangled.

AGISTMENT, in English law the profit arising from taking in cattle to lie and pasture in one's lands, applied more particularly, in the first instance, to the proceeds of pasturage in the king's forests.

AGNANO, LAGO D', a small circular lake near Naples, about two miles in circumference, and evidently situated in the crater of an extinct volcano.

AGNATE (*Lat. Agnatus*), Agnates, in the law of England, are persons related through the father, as cognates are related through the mother. In the Roman law both of these terms had a somewhat different signification. Agnates, under that system, were persons related through males only, while cognates were all those in whose connection, though on the father's side, one or more female links intervened. Thus a brother's son was his uncle's agnate, because the propinquity was wholly by males; a sister's son was his cognate, because a female was interposed in that relationship. With us the intervention of females is immaterial, provided the connection be on the male, or paternal, side of the house. The cause of our having thus changed the meaning of terms manifestly borrowed from the Roman law seems to be that in Rome the distinction between agnates and cognates was founded on an institution which has not been adopted in the Roman sense by any modern nation—that, namely, of the *Patria potestas*. Roman agnati are defined by Hugo to be all those who either were actually under the same *paterfamilias*, or would have been so had he been alive; and thus it was that, as no one could belong to two different families at the same time, the agnation to the original family was destroyed, and a new agnation created, not only by marriage, but by adoption. The foundation of cognition, again, was a legal marriage. All who could trace up their origin to

the same marriage were *cognati*; and thus the term *cognatus*, generally speaking, comprehended *agnatus*. But though an agnatus was thus almost always a cognatus, a cognatus was an agnatus only when his relationship by blood was traceable through males. Justinian abolished entirely the distinction between agnates and cognates. In the United States, the word *agnate* is obsolete, the distinction between the male and female lines of descent not being recognized.

AGNES, ST., according to legend, was a beautiful Roman Christian in the time of Diocletian, who, having in her thirteenth year refused the heathen son of the prætor, was exposed in a public brothel. The miraculous growth of her hair, the blinding of the prætor's son, his restoration to sight, and the refusal of the flames to touch her—all could not save her from the executioner's sword. Her festival falls on January 21, and her symbol is a lamb.

AGNESI, MARIA GAETANA, a woman remarkable for her varied attainments, was born at Milan in 1718. In her ninth year she could converse in Latin, and soon acquired a mastery of Greek, Hebrew, French, Spanish, and German. Her father invited parties of learned men to his house, with whom, in spite of her retiring disposition, Maria disputed on philosophical points. Of her discourses on these occasions, her father published specimens, called *Propositiones Philosophicæ* (1738). After her twentieth year, she devoted herself to the study of mathematics, wrote an unpublished treatise on Conic Sections, and published her *Istituzioni Analitiche* (1748). The latter was a work of permanent value, and was translated into French and English. When her father was disabled by infirmity, she took his place as professor of mathematics in the University of Bologna, by the appointment of Pope Benedict XIV. After her father's death in 1752, she made theology her study, and ultimately entered a convent at Milan, where in 1799 she died at the good old age of 81.

AGNESI, MARIA TERESA, sister of the above (died 1760), was well known as a musician, having composed a number of cantatas, besides three operas—*Sophonisbe*, *Ciro in Arminia*, and *Nitocri*.

AGNOETÆ, in *Church History*, a sect of ancient heretics who maintained that Christ's human nature did not become omniscient by its union with His divinity.

AGNOLO, BACCIO D', wood-carver, sculptor, and architect, was born at Florence in 1460. The first was his original calling, and he attained considerable distinction in it before he turned his attention to architecture, when he went to Rome to study in 1530. He was engaged to complete the drum of the cupola in the metropolitan church *Di Santa Maria del Fiore*; but Michael Angelo found fault with his plans, and the work remains unexecuted to this day. He died in 1543.

AGNONE, a town of South Italy, at the foot of Monte Capraro. Population (1900), about 17,000.

AGNOSTICISM, a word coined by Professor Huxley to express the mental condition in regard to revealed religion of those who professedly "do not know." The advocates of agnosticism employ two methods of argumentation in support of their position—viz., the *skeptical* and the *critical*. In their reasoning against spiritualism, they are careful to guard themselves against the charge of positive Atheism on the one hand, and of philosophical Materialism on the other. They frankly admit that there is more than matter and force in the universe. The phenomena of consciousness and mental activity cannot, they grant, be put in the same category with the properties of matter. With the former, they admit, physical science cannot deal. "The passage," says Professor Tyndall, "from the physics of the brain to the corresponding

facts of consciousness is unthinkable." Consciousness, they assert, is a function of the brain, as motion is a function of the muscles. As to *how* the stimulation of a sensory nerve gives rise to consciousness, of the stimulation of a motor nerve to muscular contraction, they avow blank ignorance. *Perhaps*, they say, consciousness inheres in a substance other than material; and *perhaps* the series of conscious states, at present associated with man's material organism, *may* continue to exist apart from it; but these things they do not profess to know. As regards the existence of a God, they say that, having regard to the universality of the law of causation, they cannot refuse to admit an eternal existence, and that, in view of the doctrine of the conservation of energy, they must also grant the *possibility* of an eternal energy. Further, if the existence of material phenomena in the form of consciousness is admitted, an eternal series of such phenomena must be regarded as *possible*. Thus, an eternal existence possessed of consciousness and energy *may be* the First Cause of all things. Agnosticism, however, leaves it an open question whether energy is eternal *a parte ante*; and as to consciousness it maintains that there is no positive evidence that the first cause possesses it at all. The only thing certain, accordingly, is that an eternal existence of some sort must be postulated. Though their belief in the universality of the law of causation shuts them in to this positive conclusion, at the same time agnostics are careful to state that causation cannot be proved by any amount of experience—thus following Hume and Kant, who taught that our only knowledge is of phenomena or sequences. "The only meaning," says Professor Huxley, "of the law of causation in the physical world is that it generalizes universal experience of the order of the world; and if experience shows [and he says it does] a similar order to obtain among states of consciousness, the law of causation will properly express that order" (*Life of Hume*, pp. 184-185). "Universal experience" of the "order" of phenomena is, according to this statement, all that is meant by the law of causation. *Why* phenomena fall into this order, the agnostic does not profess to know. This being so, it follows that, as it is only in consciousness we apprehend phenomena, agnosticism leaves it problematical whether an external world exists at all. *Perhaps* the Idealism of Berkeley is the soundest philosophy. Or, linking human consciousness to a possible eternal series of conscious states, it *may be* that the Pantheism of Spinoza is the most satisfactory solution of the mystery of existence. Owing to the reverence of agnostics for the law of causation, they repudiate the ascription to man of free-will, as ordinarily understood. Agnosticism may be regarded as Positivism without its dogmatism.

AGNUS DEI (Lat., "Lamb of God"), one of the titles of Christ (John, i. 29); also the name given to a prayer used in the Roman Catholic service of Mass: "O Lamb of God, that takest away the sins of the world, have mercy upon us." In the musical reference it is the sixth or last section of the Mass. The figure of a lamb bearing a cross, stamped upon a disc of wax, silver or gold, is also styled an Agnus Dei. Such medals have been consecrated by the popes, in certain years of their pontificate, since the fourteenth century, for distribution among the faithful at Easter, and were worn as amulets. The lamb bearing the banner of the cross is used frequently as a symbol of Christ, in stained glass, in sculpture, and even on inn-signs.

AGOBARD, a Frank, born in 779, became coadjutor to Leidrad, archbishop of Lyons, in 813, and on the death of the latter succeeded him in the see (816). He was one of the chief supporters of Lothaire and

Pepin in their conspiracy against their father, Louis le Debonnaire, and was in consequence deposed by the council of Thionville (835). He died at Saintonge in 840.

AGONALIA, in *Roman Antiquity*, festivals celebrated on January 9, May 21, and December 11 in each year, in honor of Janus, whom the Romans invoked before undertaking any affair of importance.

AGONIC LINES, the imaginary lines on the earth's surface where the magnetic needle indicates no declination or deviation from the terrestrial meridian—that is, points to the true north and south.

AGONOTHETA, or AGONOTHETES, in *Grecian Antiquity*, was the president of the sacred games.

AGORA, the public square and market place of an ancient Greek town, corresponding to the *forum* of the Romans. In most of the cities it was the scene of public meetings for social or political purposes. The name was also applied to the general assemblies of the people in the early Greek states, usually convoked by the king or by some distinguished chieftain, as by Achilles before Troy.

AGORANOMOI, magistrates in the republic of Greece, whose position and duties were similar to those of the *ædiles* of Rome.

AGORDO, a town in North Italy, twelve miles northwest of Belluno.

AGOSTA, or AUGUSTA, a city of Sicily, fourteen miles north of Syracuse, and in the province of that name. It is built on a peninsula, and is united to the mainland by a narrow causeway. By some writers it is supposed to occupy the site of ancient *Megara Hyblæa*. The modern city, which was founded by the emperor Frederick II. in 1229-33, suffered severely during the wars of succeeding years.

AGOULT, MARIE DE FLAVIGNY, COMTESSE D', a French author known under the literary pseudonym of "Daniel Stern," was born at Frankfort, December 31, 1805, and educated at a convent in Paris. She married the Comte d'Agout in 1827, but left him and formed a connection with Liszt. To him she bore three daughters, the eldest of whom married Emile Ollivier; the second, Guy de Charnacé; and the third, first Hans von Bulow, and afterward Richard Wagner. Among Daniel Stern's works are the half-autobiographic romance *Nelida, Lettres Republicaines, Histoire de la Revolution de 1848*, and *Mes Souvenirs, 1806-33*. Her *Esquisses morales* (1849) is admittedly her best work. She died in Paris, March 5, 1876.

AGOUTI (*Dasyprocta agouti*), a small South American rodent allied to the guinea-pig. The color of its coarse hair varies from brown to yellow; the form is compact; the legs are slender and pig-like, with three toes on the hind feet; the ears small and rounded; the tail rudimentary. The agouti lives in the forests of Guiana, Brazil and Peru, and makes its home at the foot of trees. It is active and agile in its habits, and wanders in search of food into the plains, where it often does much damage to sugar plantations and the like. It is said to be tamable, and seems to live somewhat isolated. Farther south, this form is represented by Azara's agouti (*D. azarae*), and in the north by a smaller form, the acouchy (*D. acouchy*).

AGRA, a city in the Northwestern Provinces of India, situated on the right bank of the Jumna, 139 miles southeast of Delhi by rail, and 841 northwest of Calcutta. The ancient walls of the city embraced an area of about eleven square miles, of which about one-half is now occupied. The houses are for the most part built of red sand-stone, and, on the whole, Agra is the handsomest city in Upper India. Some of the public buildings, monuments of the house of Timur, are on a scale

of striking magnificence. Among these are the fortress built by Akbar, within the walls of which are the palace and audience-hall of Shah Jehan, the Moti Masjid or Pearl Mosque, so called for its surpassing beauty, and the Jama or Great Mosque. Still more celebrated is the Taj Mahal, situated without the city, about a mile to the east of the fort. This extraordinary and beautiful mausoleum was built by the Emperor Shah Jehan for himself and his favorite wife, who died in 1629; and 20,000 men were employed incessantly on it for twenty-two years. The complexity and grace of the general design, and the elaborate perfection of the workmanship are alike remarkable. The main features of the building are the mausoleum in the center, on a raised platform, surmounted by a beautiful dome, with smaller domes at each corner, and four graceful minarets (133 feet high). The principal parts of the building are constructed of white marble; and the mosaic work of the interior is singularly rich and beautiful. Of British edifices in and near the city, the principal are the Government House, the Government College, three missionary colleges, the English church, and the barracks. The climate of Agra, during the hot and rainy seasons (April to September), is very injurious to Europeans; but the average health of the city is equal to that of any other station in the Northwestern Provinces. Agra is fortified and has a garrison; there is a military station in the neighborhood of the city. The principal articles of trade are cotton, tobacco, salt, grain, and sugar. There are manufactories of shoes, pipe-stems, and gold lace, and of inlaid mosaic work, for which Agra is famous. It is an important railway center, and has many claims to be regarded as the commercial capital. Pop. (1901), 188,300.

AGRARIAN LAWS (*Leges Agrarie*), when used in the most extended signification of the term, are laws for the distribution and regulation of property in land. The history of these enactments is not only important as explanatory of the constitution of the ancient republics, but is rendered highly interesting by the conflicting opinions which have been entertained respecting their object and operation. It seems to have been a notion, generally entertained in the ancient world, that every citizen of a country should be a landholder; and that the territory of a state, so far as it was left unclosed, or not reserved for public purposes, should be divided in equal portions among the citizens. Such a distribution of public land seems to have been acted upon as a recognized principle from the earliest period to which existing historical records extend.

It was long a prevalent and undisputed opinion that the territories of the Hebrews, and of the republics of ancient Greece, were divided into equal portions, and that the object of such a distribution was to maintain a state of equality among all the members of the community. The ignorant Hindu might remain satisfied with the caste which nature had transmitted to him through successive generations, because his progenitors had been prevented from emerging from their obscurity; but the citizens of Greece and Italy, being themselves constituent members of the body politic, and not ignorant of the power thereby conferred on them, could not have been kept in check by the same principle of fear. Such an attempt, moreover, to prevent the acquisition of property would have obstructed the advancement of the arts of civilized life, would have extinguished those feelings of patriotism which led the Greeks so often to hazard their lives in defense of their country, and, by engendering discontent and exciting internal commotions, would have made them an easy prey to their enemies.

The expression Agrarian Laws, however, is more commonly applied to the enactments among the Romans

for the management of the public domains (*ager publicus*); and to an account of these the remainder of our space must be devoted. It is a singular fact that, while almost every other subject connected with the Roman constitution had been successfully investigated and explained, the object and intention of the agrarian laws were entirely misunderstood by scholars for many centuries after the revival of letters.

Romulus is represented as dividing his small territory among the members of his infant community at the rate of two *jugera* (each extending to two-thirds of an English acre) apiece, as inheritable property. The whole district, however, was not thus assigned; one portion was set apart for the service of the gods and for royal domains; and another was reserved as common land for pasture. The stock kept on the common land served to eke out a maintenance which two *jugera* could not otherwise have furnished to a family, and an agistment was paid to the commonwealth for the pasturage. It is probable that the same principle prevailed under the regal government, and that successive adjustments of the territory were made. Such a law existed among those of Servius Tullius. The equality of property thus established seems to have been considered as a fundamental principle of the Roman constitution; and the agrarian laws are regarded as the necessary means of wresting from the large proprietors the possessions which they had illegally acquired.

The correct interpretation of the agrarian laws must thus be considered as of modern date. Amid the violence of the French Revolution a scheme for the equal division of the national property was advocated, with great popular favor, by some of the frantic leaders, who sought a sanction for their extravagances in precedents drawn from the ancient republics, and particularly from the agrarian laws of the Romans.

In almost all countries the legal property of the land has been originally vested in the sovereign, whether we are to understand under that name a single chief, a particular portion of the nation, or the people at large. In the same manner, the property of all the land in a conquered country was held to be transferred to the sovereign power in the conquering state, and was assumed with more or less rigor as circumstances seemed to require. From the earliest times a portion of the Roman territory was thus regarded as the property of the state, and the profits arising from it were applied to the public service. The public domain (*ager publicus*) was at first small, but was gradually extended by right of conquest till it embraced a large portion of the whole peninsula.

The lands thus acquired were disposed of in various ways. A portion of them was frequently sold by auction to meet the immediate necessities of the state, and was thus conveyed in perpetuity to the purchasers. The disposal of the remainder depended on the nature and condition of the land, and its position in reference to the bulk of the community. If in good condition and at no great distance from the city, it was frequently assigned, in small allotments of seven *jugera* (between four and five acres), to those of the poorer citizens whose services in war gave them a claim upon the state; while in hostile districts and on exposed frontiers military colonies were planted, each colonist receiving a fixed quantity of land. In both these cases the land so assigned ceased to form part of the public domain, and became the property of the recipients. In some cases the land, after having been assumed as public property, was allowed to remain in the hand of the former owners, who became the tenants of the state for a fixed period, and paid a certain rent to the Roman exchequer.

The state always reserved to itself the power of resuming possession when it thought fit; and though such resumption might in many cases be attended by individual hardship, it was nevertheless justified by the original contract.

Much of the obscurity connected with Roman agrarian laws has arisen from a misapprehension of the meaning of the words *possidere*, *possessor*, and *possessio*. These terms, when used in a strictly legal sense, denote merely occupancy by a tenant, and never imply an absolute right of property.

AGREDA, a town of Spain, in the province of Old Castile, twenty-three miles northeast of Soria. Population, 3,120.

AGRICOLA, CNEUS JULIUS, a Roman of the imperial times, distinguished not less by his great abilities as a statesman and a soldier than by the beauty of his private character, was born at Forum Julii (now Frejus in Provence), 37 A.D. Having served with distinction in Britain, Asia, and Aquitania, and gone through the round of civil offices, he was in 77 A.D. elected consul, and in the following year proceeded as governor to Britain—the scene of his military and civil administration during the next seven years. He was the first Roman general who effectually subdued the island, and the only one who displayed as much genius and success in training the inhabitants to the amenities of civilization as in breaking their rude force in war. In his last campaign (86 A.D.), his decisive victory over the Caledonians under Galgacus, in the battle of the Grampians, established the Roman dominion in Britain to some distance north of the Forth. After this campaign, his fleet circumnavigated the coast, for the first time discovering Britain to be an island. Among the works executed by Agricola during his administration was a chain of forts between the Clyde and Forth. The news of Agricola's successes inflamed the jealousy of Roman, and in 87 A.D. he was recalled. Thenceforth he lived in retirement; and when the vacant proconsulships of Asia and Africa lay within his choice, he prudently declined promotion. The jealousy of the emperor, however, is supposed to have hastened his death (93 A.D.) His life by his son-in-law Tacitus has always been regarded as one of the choicest specimens of biography in literature.

AGRICOLA, CHRISTOPH LUDWIG, landscape-painter, was born at Regensburg on November 5, 1667, and died at the same place in 1719. His pictures are to be found in Dresden, Brunswick, Vienna, Florence, Naples, and many other towns of both Germany and Italy.

AGRICOLA (originally LANDMANN), GEORG, a famous mineralogist, born at Glauchau in Saxony, on March 24, 1494. After studying at Leipsic and in Italy, he practiced for some time as a physician at Joachimsthal in Bohemia. Agricola was the first to raise mineralogy to the dignity of a science, and he developed it to such an extent that no substantial advance was made upon his results until the middle of the eighteenth century. He died at Chemnitz on November 21, 1555.

AGRICOLA, JOHANN FRIEDRICH, musician, was born at Dobitschen in Saxe-Altenburg, on January 4, 1720, and died in 1774. He composed several operas of great merit, as well as instrumental pieces and church music. His reputation chiefly rests, however, on his theoretical and critical writings on musical subjects.

AGRICOLA (originally SCHNITTER or SCHNEIDER), JOHANNES, one of the foremost of the German reformers, was born on April 20, 1492, at Eisleben, whence he is sometimes called *Magister Isibius*. He studied at Wittenberg, where he soon gained the friend-

ship of Luther. In 1519 he accompanied Luther to the great assembly of German divines at Leipsic, and acted as recording secretary. After teaching for some time in Wittenberg he went to Frankfort in 1525 to establish the worship according to the reformed religion. In 1540 Agricola left Wittenberg secretly for Berlin, where he published a letter addressed to the elector of Saxony, which was generally interpreted as a recantation of his obnoxious views. Luther, however, seems not to have so accepted it, and Agricola remained at Berlin. The elector Joachim II. of Brandenburg having taken him into his favor, appointed him court preacher and general superintendent. He held both offices until his death in 1566, and his career in Brandenburg was one of great activity and influence.

AGRICOLA, RUDOLPHUS, the foremost scholar of the "New Learning" in Germany, was born (1443) near Groningen, in Friesland. His real name, Roelof Huysmann ("husbandman"), he Latinized into Agricola; and from his native place he was also called Frisius, or Rudolph of Groningen. From Groningen he passed to Louvain, then to Paris, and thence to Italy, where during the years 1473–80 he attended the lectures of the most celebrated men of his age, and where he entered into a close friendship with Dalberg, afterward Bishop of Worms. At length yielding (1483) to the solicitations of Dalberg, he established himself in the Palatinate, where he sojourned alternately at Heidelberg and Worms, dividing his time between private studies and public lectures, and enjoying high popularity. He distinguished himself also as a musician and painter. With Dalberg he revisited Italy (1484), and shortly after his return died at Heidelberg, October 28, 1485. Most of his works were collected by Alard of Amsterdam (2 vols. Cologne, 1539).

AGRICULTURE. It would be interesting to know how the nations of antiquity tilled and sowed, and reaped; what crops they cultivated, and by what methods they converted them into food and raiment. But it is to be regretted that the records which have come down to us are all but silent upon these homely topics.

Every reader of the Bible is familiar with its frequent references to Egypt as a land so rich in corn that it not only produced abundance for its own dense population but yielded supplies for exportation to neighboring countries. Profane history corroborates these statements. Diodorus Siculus bears explicit testimony to the skill of the farmers of ancient Egypt. He informs us that they were acquainted with the benefits of a rotation of crops, and were skillful in adapting these to the soil and to the seasons. The ordinary annual supply of corn furnished to Rome has been estimated at 20,000,000 bushels. From the same author we also learn that they fed their cattle with hay during the annual inundation, and at other times tethered them in the meadows on green clover. Their flocks were shorn twice annually (a practice common in several Asiatic countries), and their ewes yeaned twice a year. For religious as well as for economical reasons, they were great rearers of poultry, and practiced artificial hatching, as at the present day. The abundance or scarcity of the harvests in Egypt depended chiefly upon the height of the annual inundation. If too low, much of the land could not be sown, and scarcity or famine ensued. On the other hand, great calamities befell the country when the Nile rose much above the average level. Cattle were drowned, villages destroyed, and the crops necessarily much diminished, as in such cases many of the fields were still under water at the proper seed time. In 1818 a calamity of this kind took place, when the river rapidly attained a height of three and one-half feet above the proper level.

It is from the paintings and inscriptions with which the ancient Egyptians decorated their tombs that we get the fullest insight into the state of agriculture amongst this remarkable people. A steward directed the tillage operations, superintended the laborers, and kept account of the produce and expenditure. The grain was stored in vaulted chambers furnished with an opening at the top, reached by steps, into which it was emptied from sacks, and with an aperture below for removing it when required. Hand-mills were used for grinding corn; but they had also a larger kind worked by oxen. In one painting, in which the sowing of the grain is represented, a plow drawn by a pair of oxen goes first; next comes the sower scattering the seed from a basket; he is followed by another plow; whilst a roller drawn by two horses yoked abreast, completes the operation. The steward stands by superintending the whole. Nothing, however, conveys to us so full an impression of the advanced state of civilization amongst the ancient Egyptians as the value which they attached to land, and the formalities which they observed in the transfer of it. In the time of the Ptolemies, their written deeds of conveyance began with the mention of the reign in which they were executed, the name of the president of the court, and of the clerk who drew them. The name of the seller, with a description of his personal appearance, his parentage, profession, and residence, was engrossed. The nature of the land, its extent, situation and boundaries; the name and appearance of the purchaser were also included. A clause of warranty and an explicit acceptance by the purchaser followed, and finally the deed was attested by numerous witnesses (so many as sixteen occur to a trifling bargain), and by the president of the court.

Along with the Babylonians, Egyptians, and Romans, the Israelites are classed as one of the great agricultural nations of antiquity. The sojourn of the Israelites in Egypt trained them for the more purely agricultural life that awaited them on their return to take possession of Canaan. Nearly the whole population were virtually husbandmen, and personally engaged in its pursuits. Upon their entrance into Canaan, they found the country occupied by a dense population possessed of walled cities and innumerable villages, masters of great accumulated wealth, and subsisting on the produce of their highly cultivated soil; which abounded with vineyards and oliveyards. It was so rich in grain that the invading army, numbering 601,730 able-bodied men, with their wives and children, and a mixed multitude of camp-followers, found "old corn" in the land sufficient to maintain them from the day they passed the Jordan. The Mosaic Institute contained an agrarian law, based upon an equal division of the soil amongst the adult males, a census of whom was taken just before their entrance into Canaan. Provision was thus made for 600,000 yeomen, assigning (according to different calculations) from sixteen to twenty-five acres of land to each.

The unrivalled literature of Greece affords us little information regarding the practical details of her husbandry. The people who by what remains to us of their poetry, philosophy, history, and fine arts, still exert such an influence in guiding our intellectual efforts, in regulating taste, and in molding our institutions, were originally the invaders and conquerors of the territory which they have rendered so famous. Having reduced the aboriginal tribes to bondage, they imposed upon them the labor of cultivating the soil, and hence both the occupation, and those engaged in it, were regarded contemptuously by the dominant race, who addicted themselves to what they regarded as nobler pursuits. With the exception of certain districts, such as Boeotia,

the country was naturally unfavorable to agriculture. When we find, however, that valleys were freed from lakes and morasses by drainage, that rocky surfaces were sometimes covered with transported soil, and that they possessed excellent breeds of the domesticated animals, which were reared in vast numbers, we infer that agriculture was better understood, and more carefully practiced, than the allusions to it in their literature would seem to warrant.

Amongst the ancient Romans agriculture was highly esteemed, and pursued with earnest love and devoted attention. "In all their foreign enterprises, even in earliest times," as Schlegel remarks, "they were exceedingly covetous of gain, or rather of land; for it was in land, and in the produce of the soil, that their principal and almost only wealth consisted. They were a thoroughly agricultural people, and it was only at a later period that commerce, trades and arts were introduced among them, and even then they occupied but a subordinate place." Whilst their arts and sciences, and general literature, were borrowed from the Greeks, they created an original literature of their own, of which rural affairs formed the substance and inspiration.

In ancient Rome each citizen received, at first, an allotment of about two English acres. After the expulsion of the kings this allotment was increased to about six acres. These small inheritances must, of course, have been cultivated by hard labor. On the increase of the Roman territory the allotment was increased to fifty, and afterwards even to five hundred acres. Many glimpses into their methods of cultivation are found in those works of Roman authors which have survived the ravages of time.

Under the Goths, Vandals, and other barbarian conquerors, agriculture in Europe, during the middle ages, seems to have sunk into the lowest condition of neglect and contempt. We owe its revival, like that of other arts and sciences, to the Saracens of Spain, who devoted themselves to the cultivation of that conquered territory, with hereditary love for the occupation, and with the skillful application of the experience which they had gathered in other lands in which they had established their power. By them, and their successors, the Moors, agriculture was carried in Spain to a height which perhaps has not yet been surpassed in Europe. It is said that so early as the tenth century the revenue of Saracenic Spain alone amounted to £6,000,000 sterling—probably as much as that of all the rest of Europe at that time. The ruins of their noble works for the irrigation of the soil still attest their skill and industry, and put to shame the ignorance and indolence of their successors. The same remark applies to the Spanish dominions in South America. In the ancient empire of Peru agriculture seems to have reached a high degree of perfection. The ruins of basins and canals, frequently carried through tunnels, prove their industry and skill in irrigation.

But, during the middle ages, the population of Europe was divided into two great classes, of which by far the larger one was composed of bondmen, without property, or the power of acquiring it, and small tenants very little superior to bondmen; and the other class consisting chiefly of the great barons and their retainers, was more frequently employed in laying waste the fields of their rivals than in improving their own. The superstition of the times, which destined a large portion of the land to the support of the church, and which, in some measure, secured it from predatory incursions, was the principal source of what little skill and industry were then displayed in the cultivation of the soil. Every one that was not noble was a slave; the peasants were not in a better condition; even the

gentry themselves were subjected to along train of subordination under the greater barons. The villens were entirely occupied in the cultivation of their masters' land, and paid their rents either in corn or cattle, or in servile offices. The stock which these tenants employed in cultivation commonly belonged to the proprietor, who received a proportion of the produce as rent,—a system which still exists in France and in other parts of the Continent.

The corn crops cultivated during this period seem to have been of the same species, though all of them probably much inferior in quality, to what they are in the present day. Wheat, the most valuable grain, must have borne a small proportion, at least in Britain, to that of other crops. Rye and oats furnished the bread and drink of the great body of the people of Europe. Cultivated herbage and roots were then unknown in the agriculture of Britain. It was not till the end of the reign of Henry VIII. that any salads, carrots, or other edible roots were produced in England. The little of these vegetables that was used was formerly imported from Holland and Flanders. Queen Catharine, when she wanted a salad, was obliged to dispatch a messenger thither on purpose.

The ignorance and insecurity of those ages, which necessarily confined the cultivation of corn to a comparatively small portion of country, left all the rest of it in a state of nature to be depastured by the inferior animals, then only occasionally subjected to the care and control of man. Cultivators were crowded together in miserable hamlets; the ground contiguous was kept continually under tillage; and beyond this, wastes and woodlands of a much greater extent were appropriated to the maintenance of their flocks and herds which pastured indiscriminately with little attention from their owners.

The low price of butcher-meat, though it was then the food of the common people, when compared with the price of corn, has been justly noticed by several writers as a decisive proof of the small progress of civilization and industry.

Of the state of agriculture in Scotland in the 16th and the greater part of the 17th century very little is known; no professed treatise on the subject appeared till after the Revolution. The south-eastern counties were the earliest improved, and yet in 1660 their condition seems to have been very wretched. Ray, who made a tour along the eastern coast in that year, says: "We observed little or no fallow ground in Scotland; some ley ground we saw, which they manured with sea wrack."

Before entering upon a description of the agriculture of Great Britain at the present day, it may help to set matters in a clearer light if we take just so much of a retrospect as will serve as a background to our picture.

At the beginning of the 18th century the agriculture of that country was still of the rudest kind. With the exception of certain parts of England, the land was still for the most part unclosed, the live stock of each township grazing together, and the arable land being occupied in common field or run-rig. The practice of fallowing annually a portion of the arable land, and of interposing a crop of peas betwixt the cereal crops, was becoming a common practice and was a great improvement upon the previous and yet common usage of growing successive crops of white-corn until the land was utterly exhausted, when it was left to recruit itself by resting in a state of nature, while other portions were undergoing the same process. Clover and turnips had been introduced before this date, and were coming gradually into cultivation as field crops in the more advanced parts of England. Potatoes

were commonly grown in gardens, but had not yet found their way to the fields.

The gradual advance in the price of farm produce soon after the year 1760, occasioned by the increase of population and of wealth derived from manufactures and commerce, gave a powerful stimulus to rural industry, augmented agricultural capital, and called forth a more skillful and enterprising race of farmers. The arable lands of the country, which, under the operation of the feudal system, had been split up into minute portions, cultivated by the tenants and their families without hired labor, began now to be consolidated into larger holdings, and let to those tenants who possessed most energy and substance. This enlargement of farms, and in Scotland the letting of them under leases for a considerable term of years, continued to be a marked feature in the agricultural progress of the country until the end of the century, and is to be regarded both as a cause and a consequence of that progress.

Before the close of the past century, and during the first quarter of the present one, a good deal had been done in the way of draining the land, either by open ditches, or by Elkinton's system of deep covered drains. This system has now been superseded by one altogether superior to it, both in principle and practice. In 1835 James Smith, of Deanston, promulgated his now well-known system of thorough draining and deep plowing. It has been carried out already to such an extent as to alter the very appearance and character of whole districts of the country, and has prepared the way for all other improvement. The words "Portable Manures" indicate at once another prominent feature in the agriculture of the times.

The labor of agriculture has been greatly lightened, and its cost curtailed, by means of improved implements and machines. The steam-engine has taken the place of the jaded horses as a threshing power. About 1818–20 several steam-engines on the condensing principle were erected in East Lothian, solely for the propelling of threshing-machinery. One of these, put up by Mr. Reid, of Drem, at a cost of £600, is still doing its work there, and, strange to say, after the lapse of so many years, looks as well and is as efficient as when first erected.

The railways, by which the country is now intersected in all directions, have proved of great service to farmers by conveying their bulky produce to distant markets cheaply and quickly, and by making lime and other manures available to the occupiers of many inland and remote districts. In nothing has this benefit been more apparent than in the case of fatted live stock, which is now invariably transported by this means, with manifest economy to all concerned.

During the whole of this period there has been going on great improvement in all the breeds of domesticated animals. This has been manifested not so much in the production of individual specimens of high merit—in which respect the Leicesters of Bakewell, or the short-horns of Colling have perhaps not yet been excelled—as in the diffusion of these and other good breeds over the country, and in the improved quality of our live stock as a whole. The fattening of animals is now conducted on more scientific principles. Increased attention has also been successfully bestowed on the improvement of the field crops. Improved varieties, obtained by cross-impregnation, either naturally or artificially brought about, have been carefully propagated, and generally adopted. Increased attention is now bestowed on the cultivation of the natural grasses. The most important additions to the list of field crops during this period have been Italian rye-

grass, winter beans, white Belgian carrot, sugar beet, and alsike clover.

Even a very limited acquaintance with the geology of Great Britain serves, however, to account for the exceedingly diversified character of its soils. The popular definitions of soils—and to these it is safest for practical farmers to adhere—have respect to their most obvious qualities. Thus they are designated from their composition, as *clays*, *loams*, *sands*, *gravels*, *chalks*, or *peats*; or from their texture, in which respects those in which clay predominates are called *heavy*, *stiff*, or *impervious*; and the others *light*, *friable*, or *porous*. From the tendency of the former to retain moisture, they are often spoken of as *wet* and *cold*, and the latter, for the opposite reason as *dry* and *warm*. According to their measure of fertility, they are also described as *rich* or *poor*. The particular crops for the production of which they are respectively considered to be best adapted have also led to clays being spoken of as *wheat* or *bean soils*, and the friable ones as *barley* and *turnip soils*.

But if diversity of soil necessarily modifies the practice of the husbandman, that of climate does so far more powerfully. The soils of the different parts of the globe do not very materially differ from each other, and yet their vegetable products vary in the extreme. This is chiefly owing to difference of temperature, which decreases more or less regularly as we recede from the equator, or ascend from the sea-level. Places in the same latitude and at the same elevation are found, however, to vary exceedingly in temperature, according to their aspect, the prevailing winds to which they are exposed, their proximity to seas or mountains, and the condition of their surface.

Besides those variations in the agricultural practice which arise from diversities of soil and climate, there are others which are due to the distribution of the population. The proximity of cities and towns, or of populous villages, inhabited by a manufacturing or mining population, implies a demand for dairy produce and vegetables, as well as for provender and litter, and at the same time affords an ample supply of manure to aid in their reproduction. Such commodities, from their bulk or perishable nature, do not admit of long carriage. The supplies of these must therefore be drawn from comparatively limited areas, and the character of the husbandry pursued there is determined apart from those general influences previously referred to. Indeed, it is so well known that there are peculiarities of character attaching to almost every individual field and farm, and still more to every different district or county, which demand corresponding modifications of treatment in order to their successful cultivation, that a prudent man, if required to take the management of a farm in some district greatly inferior in its general system of farming to that which he may have left, will yet be very cautious in innovating upon specific practices of the natives.

An abundant supply of good water is a most important matter. The best source is from springs, at such an elevation as to admit of its being brought in a pipe, with a continuous flow. Failing this a well and pump is the usual alternative, although it is sometimes necessary to collect the rain-water from the roofs, and preserve it in a capacious and carefully-made tank. In every case it is desirable to have a regulating cistern, from which it is distributed by pipes to every part of the homestead where it is required. It is, in every case, of importance to have the eaves of the whole building spouted, and the rain-water carried where it can do no mischief. Where fattening cattle are kept in open yards with sheds, by spouting the eaves, and slightly

hollowing the yards toward their centers, the urine to a large extent is absorbed by the litter, and retained in the manure.

That the cultivation of the soil may be carried on to the best advantage, it is necessary that the farmer be provided with a sufficient stock of machines and implements of the best construction. Very great improvement has of late years taken place in this department of mechanics. In many instances the quality of the article has been improved and its cost reduced. There was in former times a tendency to produce implements needlessly cumbrous and elaborate, and to introduce variations in form which are not improvements. The inventors of several valuable machines, the exclusive manufacture of which they have secured to themselves by patent, have become alive to the advantages of looking rather to large sales with a moderate profit on each article, and of lowering prices to secure this.

The universal use of iron and steel in the construction of agricultural implements is materially adding to their durability, and generally to their efficiency, and is thus a source of considerable saving. While great improvement has taken place in this department, it too commonly happens that costly machines are not taken care of in the intervals of use, and prices for repairs are costly and cause delay in waiting for them.

We have devoted, as will be seen, some space to the history of agriculture from the earliest ages until the present day, and so far the illustrations have been drawn from Asiatic and European countries. But we have now to speak, and shall do so at some length, of the special agricultural interests of the United States. Within the limits of this great country there is to be found every possible variety of cultivation, upon a scale of magnitude unequalled the world over. From the oats, barley and rye of the north, through the fertile wheat belt and the greatest corn producing country on earth, to the rice fields of the Carolinas, the United States produces every cereal known to man. Its fruits range from those of the northern temperate zone to those of the subtropics; from apples and berries to pines and bananas; its products include the cotton of India, the rice of China and its indigenous tobacco, not to speak of a hundred other useful grains and fruits, the sugar-cane and the fibrous plants. Not only has it become the great source of grain supply for a large part of Europe, but its limitless prairies furnish pasture for millions of head of cattle. Since, therefore, every operation of agriculture is carried on within our own land, a sketch of the various systems in use cannot fail to be of interest. In many ways we follow in the footsteps of our European ancestors; in many we have improved upon their methods. What we have to speak of now is the condition of agriculture in the United States at the present time. The cereal grains being of the utmost importance as constituting food for man, first demand attention.

THE CEREALS.

Wheat.—This, although its aggregate production does not equal that of corn in quantity, is one of the most important and most valuable of the cereal products of the United States. Its geographical range is great, although it attains to the greatest perfection near the northern limits of its possible growth. Of its origin nothing positive is known. The claim has been made that the wild plant has been found in Kurdistan, and there is a general agreement that Mesopotamia, the supposed cradle of the human race, was the original home of wheat. The earliest recorded history of man shows that its use as a bread-stuff was known in remote antiquity, grains of wheat have been found in Egyptian

mummy cases, and there are several references to this grain in the Bible. Tradition says that it was introduced into Mexico by the Spanish invaders under Cortez and there is no doubt that the earliest settlers in what is now the United States brought seed-wheat with them, and that it was among the first of the crops raised in New England. As the country was opened to civilization the area of the wheat belt was extended until now it reaches from the Canadian border to the extreme South.

The botanical appearance and structure of the wheat plant will be found fully described elsewhere in this work (see WHEAT, Vol. VIII., page 6356). Some of the species of the genus *Ægilops* (now referred to *Triticum* by Bentham and Hooker and by Haeckel) may possibly have been the sources of our cultivated forms, as they cross freely with wheat. Haeckel, the latest monographer of the genus, considers that there are three species: (1) *Triticum monococcum*, which undoubtedly grows wild in Greece and Mesopotamia, is cultivated in Spain and elsewhere, and was also cultivated by the aboriginal Swiss lake-dwellers, as well as at Hissarlik, as is shown by the grain found in those localities. (2) *T. sativum* is the ordinary cultivated wheat, of which Haeckel recognizes three principal races, *spelta*, *dicoccum*, and *tenax*. Spelt wheats were cultivated by the aboriginal Swiss, by the ancient Egyptians, and throughout the Roman empire. The variety *dicoccum* was also cultivated in prehistoric times, and is still grown in southern Europe as a summer wheat and one suitable for starch-making. Other sub-varieties of *T. tenax* are *compactum*, *turgidum* and *durum*. (3) The third species, *T. polonicum*, or Polish wheat, is a very distinct-looking form, with long leafy glumes; its origin is not known. As these varieties intercross with each other, the presumption is that they, like the species of *Ægilops*, which also intercross with wheat, may have all originated from one common stock.

Basing his conclusions upon philological data, such as the names of wheat in the oldest known languages, the writings of the most ancient historians, and the observations of botanical travelers, De Candolle infers that the original home of the wheat plant was in Mesopotamia, and that from thence its cultivation extended in very early times to the Canaries on the west and to China on the east. In the western hemisphere wheat was not known till the sixteenth century. Humboldt mentions that it was accidentally introduced into Mexico with rice brought from Spain by a negro slave belonging to Cortez, and the same writer saw at Quito the earthen vase in which a Flemish monk had introduced from Ghent the first wheat grown in South America.

As might be anticipated from the cultivation of the plant from time immemorial and from its wide diffusion throughout the eastern hemisphere, the varieties of wheat—that is, of *T. sativum*—are very numerous and of every grade of intensity. Those cases in which the variation is most extreme some botanists would prefer to consider as forming distinct species; but others, as De Vilmorin, having regard to the general facts of the case and to the numerous intermediate gradations, look upon all the forms as derivatives from one. In illustration of this latter point it may be mentioned that not only do the several varieties run one into the other, but their chemical composition varies likewise according to climate and season. According to Prof. Church, even in the produce of a single ear there may be 3 to 4 per cent. more of albuminoid matters in some grains than in others; but on the average the proportion of gluten to starch is as 9.11 to 100. From the point of view of agriculture it is generally of no great moment

what rank be assigned the various forms. It is only important to take cognizance of them for purposes of cultivation under varying circumstances. Hence we only allude to some of the principal variations and to those characteristics which are found to be unstable. (1) Setting aside differences of constitution, such as hardihood, size and the like, there is relatively little variation in the form of the organs of vegetation. This indicates that less attention has been paid to the straw than to the grain, for it is certain that, were it desirable, a great range of variation might be induced in the foliage and straw. As it is, some varieties are harder and taller than others, and the straw more solid, varying in color and having less liability to be "laid;" but in the matter of "tillering," or the production of side-shoots from the base of a stem, there is much difference. De Vilmorin points out that wheats of cold countries have flexible, thin, hollow straw, elongated, fragile ears, and soft floury seeds; Hunter's wheat may be cited as a good example. Wheats of hotter countries have a more solid, rigid straw, the ears short, stout, compact, the glumes provided with long awns or beards, and the seed hard and horny. Spring wheats procured from northern latitudes mature more rapidly than those from temperate or hot climates, while the reverse is the case with autumn wheats from the same source. The difference is accounted for by the greater amount of light which the plants obtain in northern regions, and, especially, by its comparatively uninterrupted continuance during the growing period, when there are more working hours for the plants in the day than in the more southern climes. Autumn wheats, on the other hand, are subjected to an enforced rest for a period of several months, and even when grown in milder climates remain quiescent for a longer period, and start into growth later in spring,—much later than varieties of southern origin. These latter, accustomed to the mild winters of those latitudes, begin to grow early in spring, and are in consequence liable to injury from spring frosts. Wheats of dry countries and of those exposed to severe winds, have, says De Vilmorin, narrow leaves, plant straw, bearded ears and velvety chaff,—characteristics which enable them to resist wind and drought. Wheats of moist climates, on the other hand, have broader leaves, to admit of more rapid transpiration. No doubt careful microscopic scrutiny of the minute anatomy of the leaves of plants grown under various conditions would reveal further adaptations of structure to external conditions of climate. At any rate, it is certain that, as a general rule, the hard wheats are almost exclusively cultivated in hot dry countries, the spelt wheats in mountainous districts and on poor soil, turgid wheats, like the Egyptian, in plains or in ill-drained valleys,—the best races of wheat being found on rich alluvial plains and in fertile valleys.

Most of the wheat grown in the United States is the *Triticum vulgare*, divided into two sub-species, *T. hibernum* or winter wheat, and *T. æstivum* or spring wheat. These sub-species are further distinguished as hard and soft, white and red, bald and bearded, and these varieties differ again in many minor degrees, such as the coloration of the straw and chaff and the texture of the kernel. On heavy loams and clays winter wheat does best; on light prairie soil the spring varieties attain to perfection. In the United States spring wheats are harder than winter wheats. A German writer speaking of the fitness of special varieties for special purposes says:

"Innumerable experiments have shown that the value of wheat for seed increases with the size of the

grain; the larger kernel yields a stronger plant, and this will bear a heavier crop; the smaller grain contains the larger proportion of gluten, yields a better flour and brings a higher price; but with the smaller yield per acre the profit may be less. The 'volume-weight' is dependent more on the well-rounded form of the grain than on its size; when about alike in respect to shape, the market value of the grain is closely proportionate to its weight per bushel. Grain of higher specific gravity is usually richer in gluten. Richness in this constituent is of the greatest importance, as affecting the market value of the grain; it gives better baking qualities to the flour, besides a higher nutritive value, and is accompanied with greater richness in phosphate, also an important constituent of animal food. The proportion of gluten in wheat is determined largely by the climate, and especially by the proximity of the sea. Insular England produces a wheat grain with high absolute weight, but as a rule with less gluten than the wheat of eastern Europe. English wheat and wheat in general grown in an ocean climate seldom contains over 10 per cent. of gluten, while in eastern Europe and in the western United States the proportion rises to 20 per cent. and above. Vigorous English seed wheat sown in eastern Europe yields larger crops than the native seed, and a grain richer in gluten than the parent, though not so rich as wheat from the native seed.

Wheat is a moderately hardy plant but likes a rich, strong soil. It does well on heavy loam or well-prepared clay, where sufficient attention is given to under-drainage and deep plowing is practiced. But many light and marly or calcareous soils will grow good wheat. Lime is an important aid to the growth of wheat, and soils naturally containing lime are good for it. Where this does not exist it should be artificially supplied. A rich vegetable or alluvial soil, unless modified by the application of lime or ashes, or both, tends to a rapid and exuberant growth of straw and to the detriment of the grain. A common practice is to sow the land with clover as a preparation for wheat, a rich turf forms a good lay for it, and it can be advantageously grown on strong, well-manured land which has been cropped with roots the preceding season. The direct application of fresh barnyard manure is not to be recommended as it tends to excite a rapid growth of weak straw and increases the risk of rust. As a matter of course wheat should be grown only in proper rotation with other crops, but in the great wheat-growing country of the North—in Minnesota, Dakota, etc.—this system does not prevail, and the land is sown to wheat, year after year. The evil effects of this practice need no demonstration. Depth of soil is as necessary to the successful growth of wheat as quality of soil. Wheat strikes its roots deep, and sub-soil plowing, by furnishing it with ample food, tends greatly to its development both in the size and quality of the berry.

The processes of wheat-growing, whether carried on in a small way or as in the great fields of the Northwest by large gangs of men and modern machinery, are simple. The first essential to success, after the proper selection and preparation of the land, is to secure first-class seed. The heaviest and plumpest grains should be chosen, carefully sifted and freed from all foreign substances, and well washed for a few minutes in brine. If there is any appearance of smut on the seed-grain it may be removed by rewashing and the use of pulverized quicklime. There is a great difference both in the theory and the practice of farmers in regard to the quantity of seed to be sown to the acre. Experiments on a small scale have shown magnificent results from thin seeding, but the usual practice is to sow from five to eight pecks

to the acre; the greater quantity on heavy clay and fertile soil. The tendency of wheat, like most of the cereal grasses, to "tiller," that is to send out new shoots for future stocks, must not be overlooked in this connection. The wheat will occupy the ground as far as it can, and where the plants are far apart will supply the deficiency by "tillering" to a greater extent. But when, owing to heavier seeding, the plants are close together, the operation of this natural law is suspended to a greater or less degree. In early sowing the wheat "tillers" in the fall, in late sowing not entirely until the following spring. Early in September is the usual time for sowing winter wheat; spring wheat is often not sown until the last of April or the beginning of May.

Among the varieties of winter wheat which are cultivated in this country are the common White Flint, improved White Flint, the White Provence Wheat, the Wheatland Red, the Tuscan Bald, the Skinner Wheat, the Golden Drop, the White Blue Straw (known in Ohio as the Blue Stem), the Aguirra Wheat, the Verplanck, the Canada Flint, the Bearded Mediterranean, Old White Flint, the Club, the Genesee, the Egyptian, the Old Red Chaff, the Quaker Wheat, the Yellow Bearded, the Kentucky Red, the Bald Mediterranean, the Red Blue Stem, and innumerable others. Among the spring varieties are the Italian Spring Wheat, Tea Wheat, or Siberian Wheat, Black Sea Wheat, Black Bearded and Red Bearded Wheats, the Scotch Wheat, Talavera Wheat, the Black Sea Wheat, the Canada Club, the Fife, etc. All varieties may be easily modified by cultivation. The bearded may become beardless, and *vice versa*; the red may pass into the white varieties, and the winter is easily modified so as finally to become a spring wheat.

The old and wasteful system of sowing broadcast by hand has been almost entirely superseded in this country by drilling. The drill distributes the seed more evenly and economically, and leaves the field in better order for cultivation. After drilling, the field should be thoroughly harrowed and rolled, or the wheat should be lightly plowed in. A second harrowing and a second rolling in the spring is often attended with great benefit to the growing crop. During the growing time the farmer must be constantly on his guard against the various insect pests which attack the green plant. He can generally avoid the danger of winter-killing, except on the heaviest lands and in the worst of seasons, by paying strict attention to the drainage of the land. It goes without saying, in wheat culture, as in all other agricultural operations, that a vigorous war must be waged against weeds, and that the cleanest land, other conditions being equal, always yields the most satisfactory results both in quantity and quality.

We have treated in detail in the article on WHEAT (pages 6336-6338) of the most destructive insects, the Hessian fly, the midge, the wireworm and the corn-weevil. Millepedes, although they are not insects, but one of the groups which compose the larger division *Tracheata*, must be included in an account of the pests which attack wheat. The species which is most destructive to wheat, barley, and oats is *Polydesmus complanatus*. Millepedes pass their life underground, and are sometimes mistaken for wire-worms, but can be at once distinguished by the great number of their legs. They affect damp places which should be drained, and no rubbish or litter should be left lying about.

Earl-cockle is due to the parasitism of a small white nematoid worm, known variously as *Anguillula (Vibrio) tritici* or *Tylenchus scandens* or *tritici*. These worms cause the formation of a brownish black gall upon the wheat ear. When the ear ripens and falls to the ground, the nematoids escape from the gall and

live in the damp earth. Ultimately they make their way on to a young plant, and, as the ears form, they pass into it and pair inside the gall that has been made by their presence. The female lays numerous eggs, from which young nematodes hatch out, until the gall is quite full of them. As long as the gall remains hard, the larvæ are motionless; but they become active in moisture, and develop into the adult state. If the surrounding conditions are unfavorable they will remain in the larval state for years. They are capable of resisting great extremes of heat and cold, and are apparently unaffected by many poisons. Allied species affect the roots of wheat, grasses, and other plants.

Of other troubles of the wheat farmer the chief are *smut*, a parasitic fungus which grows upon the head and destroys the grain; and *rust*, which affects the straw while the grain is forming. The last is most obnoxiously frequent in warm, close, showery weather. It causes the straw to burst and forms a crust of iron-colored rust of a fungoid nature on the stalk. The only course to pursue where rust becomes evident is an early harvesting of the grain, by which means a portion of the grain may be saved. Early sowing, careful selection of hardy seed and the use of saline manures are the best preventives of rust. For smut the only remedy is to wash the grain in strong brine, and, as stated before, the preparation of the seed with quicklime.

Wheat should be harvested before the grain is thoroughly ripe and just as soon as the lower part of the stalk turns yellow. The old-time practice of reaping with the scythe or sickle has been supplanted by the use of horse-reapers and these in turn, at least on large farms, by steam reapers. Modern machines not only reap the grain, but bind and deliver it and in many cases, especially in the north, threshing is done in the field. By this system all expenses of removal and storage, risk from vermin and cost of insurance are avoided and it is possible to put the new crop on the market early in the season, when good prices are as a rule obtainable. Where farming is carried on by steam machinery and on a wholesale scale, little or no attention is given to the straw, which practically goes to waste. The result is deplorable and nothing but the richest land can long stand the drain from constant wheat cropping and no return being made to the soil. Every stalk grown on the farm should be used as fodder or forage and returned to the land in the shape of manure.

Where wheat is stored in the straw for convenience or to await a better market, great care should be taken to avoid the generation of heat or mold. Stacks should be elevated from the ground, to permit free circulation of air, and to avoid the attacks of vermin; the foundations should be carried on posts, or better still, on stone pillars, which may advantageously be permanent structures. Every stack should be properly protected from the weather, a precaution far too often neglected in this country. In Europe, and especially in England, the top of the stack is covered with a thatch of plaited straw absolutely impervious to rain and in the preparation of which the greatest care is taken. Storage in barns is preferable to an open-air storage so far as protection against rain and snow is concerned; but few barns are rat proof and many swarm with vermin. The weevil, too, often attacks grain in store, but this is almost invariably the result of neglect and the accumulation of dirt. The enormous quantity of wheat now raised in the United States all finds a remunerative market. There is no such contingency in any given year as overproduction to the extent of loss to the producer. This consideration gives rise to a curious reflection. This product of one of the staple and abso-

lute necessities of all times could not be without the extensive array of harvesting machinery now in universal use. Without intention or actual foresight harvesting machinery has kept pace with the demand for the article, and the satisfying of the demand has been rendered possible.

There was a reaping machine used so long ago that it is described by the elder Pliny, who lived A.D. 23. It was a platform, or box, on wheels, to the front of which was affixed a row of prongs like the teeth of a comb, which stripped or shredded the heads of the grain from the stalk as the machine was drawn or pushed through the standing grain. Such a machine was, and perhaps still is, in use for the gathering of clover seed from the standing stalks. One Palladius mentions a similar machine as being in use 260 years later.

Attempts at making harvesting machines were made in England nearly a hundred years ago, and these attempts, none of them practically successful, were made at intervals down to 1831. Some of these machines embodied ideas that are now in use, as in the earlier and later machines of Bell, Hussey and McCormick. Bell invented the moving platform, and the device is essentially the apron necessary in the latest twine-binder. Prior to 1832 only eight patents had been granted in the United States for harvesting machines. There are now many thousands of them.

But it was reserved for an American to invent and put into practical use the device which has since been, and probably will always be, the essential and indispensable of all grass and grain cutting machines. His name was Obed Hussey, and his device was a vibrating notched or scalloped cutter-bar, sliding back and forth through slotted fingers. These slotted fingers sustain the grain or grass above and below, and it is severed with a sliding cut, owing to the slant given the cutting edge by the shape of the blade or "section" composing it. Hussey's patent was issued in 1833, and his first machine was tried at Hamilton, Ohio. From that date the American reaper was an assured industrial and commercial success, and now no reaper or mower is in use anywhere in the world that has not this cutter-bar and knife, or sickle.

McCormick's machine, using the Hussey essential, was probably the first so arranged as to provide for the raking of the grain from the platform sideways, in gavels for binding. Even in Hussey's machine it was to be raked off backwards. McCormick's machine was also provided with a reel of supposedly improved form, and a seat upon which sat the man who raked the grain away.

The next great improvement was made by Seymour, and Palmer and Williams, about 1851. This consisted in making the grain platform of a quadrant or quarter-circle shape, and in adding a vibrating automatic rake, which discharged the grain from the platform without the extra man. Five years afterwards Dorsey dispensed with the reel entirely by making four arms, with rake-teeth upon one, gather the grain in against the cutter-bar, and afterwards follow it across the platform, raking it off in gavels. But nine years after this, in 1865, Samuel Johnson improved this by pivoting each arm separately, and giving rake-teeth to all of them, and adding a device worked by the foot of the driver, by means of which any one of the four arms could at pleasure be made to follow the cut grain across the platform and rake it off in gavels. When left alone three of the arms did the reeling and one the raking off of the platform, as in the case of the Seymour, and Palmer and Williams patents. After this control by the driver of the size

of the gavels in light and heavy grain there seemed little more possible, and that the American farmer was fully equipped for the management of all his cereal crops. But such was very far from being the case.

In 1858 C. W. and W. W. Marsh patented a machine which carried upon it the men who had heretofore followed the reaper and bound up the gavels. But it required only two of them. The grain was received on an endless apron, and by this conveyed to a platform at one side of the machine where the two binders received it, bound and threw it off.

In 1856 Seiberling had invented a machine in which the platform was composed of slats parallel with the direction in which the machine was moved in cutting. This slat platform was normally slightly higher than the stubble, but when let down by the driver's foot, allowed the stubble to become the rake, and to pull off the gavel backwards by protruding through the openings between the slats.

A large number of patents and improvements upon patents might be mentioned as the work of American inventors in this prolific field. Nearly all of them were, for their time, practical improvements upon all that had gone before. Year by year they came forward, some of them not mentioned here cutting immense swaths of twelve feet wide, and carrying only the heads of the grain backward and placing them in huge boxes on a separate wagon driven alongside. These are still in use on some of the enormous wheat-farms of the Northwest. The straw is left standing, the heads are immediately threshed, and, one header following another, sometimes to the number of a dozen or twenty in the same field, the huge harvesting is quickly over.

But as a rule all improvements led finally to the wonderful reaper of to-day, familiar in all its varieties to all who pay attention to the harvesting of wheat. The reel of the one, and the endless apron of another are parts of it. The Hussey cutter-bar is indispensable in all. Hundreds of patents cover it. It cuts the grain, carries it away from the platform, makes it into a sheaf of the prescribed size, wraps it with twine, ties the twine, cuts off the twine, and flings the tied sheaf away to the side. It is complicated, yet does not become deranged. It began with wire, and passed to Manila cord. Its varieties could not be described, and its work is so simple that detail is unnecessary. Great cost does not deter from its use. Every farm where cereals are grown has it among its equipments.

Yet in all the story of high inventive genius, indomitable will, patience and capital represented in the American harvesting machine, two or three men stand first. One of these was the Rev. Patrick Bell, of Scotland, who made the scissors cutter-bar in 1828, and therewith a reaper that was *almost* practical for a number of years. But the greatest, because he made an improvement that was never dispensed with since, and which is considered absolute by all his successors, was Obed Hussey.

Corn, maize, or Indian corn is the produce of *Zea mays*, a species of cereal having monoecious flowers. The stem, which is filled with a pithy, fibrous structure, is divided at irregular intervals by nodes, and its strength and solidity is increased by a siliceous outside covering. From the lowest, and sometimes also the second and third node, it sends out "brace" roots, and these help to support the plant, which sometimes grows to eighteen feet in height, the minimum being generally three feet. The ears—which are developed within the leaf sheath at the nodes, and consist of a "cob" with the grains disposed upon it in regular rows of from eight to twenty, and long "silk" threads

attached to each embryo, which usually extend beyond the closely-folded tip of the mass of imbricated leaves ("husk") that wraps the whole—are from half an inch to three inches in diameter, and from two to seventeen inches in length. The stem is topped by a "tassel," producing an abundance of light, dry, loosely-attached pollen. Maize is hardly a less staple article of food to the inhabitants of tropical and sub-tropical countries than rice, and is rapidly becoming popular in various forms in temperate and colder climates. It is held to be superior in nutriment to barley, buckwheat, and rye. By analysis it gives 77 per cent. of starch; 3 of zein, a principle analogous to gluten; 2.5 of albumen; 1.45 of sugar; .8 of extractive; 1.75 of gum; 1.5 of sulphate and phosphate of lime; 3 of lignin and 9 of water. It is more generally used in America (North and South) than in the other continents—in the United States the crop is over 2,000,000,000 bushels, or about two-thirds of all grains grown; but in the Mediterranean countries, Germany, etc., it is also highly valued. The green ears of the sweet varieties are boiled and eaten from the cob or served in milk. When coarsely ground, maize forms the *hominy* of the Southern States of America, and finer ground it furnishes the *mush* or porridge of the Northern States; while the whole grains with the cuticle covering removed after being loosened by boiling in a weak lye, are the *hulled corn* of the States generally. *Popcorn* is a variety whose grains can be roasted and turned and shaken smartly over a brisk fire till they swell and burst, turning inside out; in this state they are coated with syrup and pressed into a ball, or the separate grains are sprinkled with salt. Thus prepared what is known as "pop-corn" is an article of extensive sale and enormous and popular use all over the United States. The deficiency of gluten in the meal of maize renders it ill-adapted to bread-making; yet corn-bread, in great variety, and light, palatable and wholesome, is upon the tables of rich and poor alike, and makes an invariable part of the menu of all hotels. Large quantities of starch are manufactured from maize, both for laundry purposes and for making puddings, custards and blanc-mange; and the starch, by treatment with acid, is converted into glucose or grape sugar. The canning of green sweet corn is also an important industry. By the Mexicans the small young shoots of thickly-sown crops are served at table like asparagus and a dessert. The stems of the sugar corn when full-grown yield by pressure a thin, sweet juice, which unfermented gives a pleasant syrup and from 5 to 15 per cent. of sugar, fermented a beer called *chica*, and distilled an excellent spirit resembling brandy. In countries where maize does not ripen well it is sometimes sown to afford food for poultry, or to be mown as green fodder for cattle. Where it is cultivated for its grain the dried leaves are used as winter fodder. The stalks are used for thatch and for fuel, and for making baskets. The fibers of the culm and leaves afford a durable kind of yarn; and the husks are elastic, and can be applied to the stuffing of chairs, saddles, etc., and to the manufacture of good, durable mattresses. The husks are also much used for packing oranges and lemons, and in South America for making cigarettes; and good paper has been manufactured from them. Hollowed corn-cobs make homely but serviceable pipe-heads for smoking tobacco. There are few plants of which the uses are more various than maize, and few which are of greater importance to man. Another species of maize, called Chili maize or Valparaíso corn (*Z. Curagua*), is distinguished by its separated leaves. It is a smaller plant, a native of Chili, and has won a superstitious

regard because its grains when roasted split in the form of a cross. Formerly in England corn was known by the name of *Turkey wheat*, being then solely an article of trade from the East; but the name Indian corn, which was given it by the early settlers in America, gradually supplanted the earlier name as the supply from here ousted that of the earlier sources from the British market. In this country it is simply called corn. The native country of maize is uncertain. Humboldt and DeCandolle are of opinion that it was introduced from the West Indies and the continent of America, but other authorities adduce good grounds for the contention that the plant is indigenous to or at least was known and cultivated in Asia and Africa before the discovery of America. In an ancient Chinese encyclopædia in the national library at Paris is an excellent representation of the plant; so that while it was undoubtedly first introduced to Europe about the year 1520 by Columbus from America, there are good grounds for the conclusion that it was known and cultivated in the ancient world long before that time.

Corn grows luxuriantly on dry, rich, well-pulverized soil, and no land can well be too rich for it. It is a hearty feeder, of rapid growth, and will stand any quantity of manure. It flourishes and attains its greatest perfection on the rich, alluvial bottom lands of our western rivers and on the prairies of the Mississippi and Ohio valleys. Strong clay and wet lands or poor soil will not grow good corn. The most primitive method of raising corn is still practiced on the virgin prairies, where the settler turns over a sod and drops in the seed, thus raising a crop of what is known as "sod corn" during his first season.

But it must not be understood from this that the proper cultivation may safely be neglected or that a decent crop can be realized without proper selection of seed, careful attention and regular tillage. A rich grass sod or good clover lay, well-manured, forms an excellent preparation for corn as for wheat. The selection of the choicest and best seed should be the first object of the farmer's care. Steeping the corn for not less than twenty-four hours in a solution of saltpetre serves to protect the grain from birds and worms and is said to accelerate the growth of the plant. Coating the seeds with boiling tar is also sometimes practiced. In selecting corn for seed, the tips of the ears are in some parts said to be best, and that part near the butt end of the ear next in value. The common practice in New England, for many years has been to use only the seeds which grow on the middle of the ear.

The ground having been properly prepared the seeds are planted in hills from three to four feet apart, and with from three to five kernels in each hill. Planting begins at the north early in May; in Southern States in April. The land should be thoroughly rolled after planting and as soon as the plants appear the cultivator must be set to work. This should be thoroughly attended to, especially in dry weather and repeated as necessary, or supplemented by the frequent use of the hoe. Unless it is intended to use the stalks for fodder the corn may stand until it is fully ripe. The stalks are cut below the ear and stacked in the field until the corn is perfectly firm and dry. Then it is husked and stored in cribs, and later is shelled for market. The green stalks are valuable for fodder and several tons of forage to the acre are obtained. The chief objection to sowing Indian corn to be cut up green and dried for winter fodder is to be found in the difficulty with which it is cured, on account of the lateness of the season at which it arrives at the most productive stage of its growth, and the extreme succulency of its large and juicy leaves. But when properly cured it affords a very

large amount of nutritious feed, which is relished by all kinds of stock, and is especially valuable for feeding to young animals.

The variations of kinds of corn are numerous. The plant "crosses" or hybridizes freely and two kinds grown together will cross, the result being the production of several new varieties. The great distinction, however, is that between the northern and southern product. The first named has a round, smooth seed, entirely coated with a hard, horny substance and richer in oil and gluten than the other, but poorer in starch.

The southern or gourd seed corn abounds in starch and is less nutritious than the northern. The rapidity of the growth of corn on rich soil is marvelous. The plant is adapted to tropical climes and requires continued heat. It may be planted as late as June—in fact, where the weather is untoward or there is any risk of frost, it is best to defer planting as long as possible. Practically the only danger to the plant is that arising from frosts during the earlier stages of its growth. As for moisture, the want of rain can be made up for by the frequent stirrings of the soil with the hoe. On a baked heavy soil corn will suffer even though rain fall. A most important adjunct to the successful and profitable growth of corn is well-drained land. Accumulations of water are fatal to the plant and rainy seasons prove most disastrous, except where facilities are afforded for carrying away the superfluous moisture.

Whatever may be said as to the origin or native place of corn, it remains true that it is in value and use the most important of American crops. If it is of Chinese origin its use there has been lost, which is quite incredible when its qualities and value are considered to a people agricultural and industrial like the Chinese. There is no doubt that it is indigenous to America, that it is in its nature sub-tropical, and that its highest development is not obtained either south or north of certain lines. In regions where the summer heat is as intense as the winter cold is where it thrives best. Its chemical ingredients are chiefly starch and oil. These vary with varieties, which are almost innumerable. There was a time some thirty years ago when it was frequently alleged that "Cotton is King." No one will now dispute that "Corn is King." From it come the enormous supplies of beef and pork which feed the masses of the world. No matter what besides is raised, a general failure of the corn crop brings disaster that is felt all over the world. Yet, it is historically one of the latest products of the oldest art known to mankind. Corn alone, were there no other result, would have paid the cost and toil of America's discovery, not to the discoverers alone, but for the human race.

To many a farmer's boy the well-understood fact may be new that Indian corn is but a grass, with all the characteristics of the great family of grasses. As it originally existed it is not improbable that there was a husk for every separate grain. But it is capable of enormous change at the caprice of its cultivator. It will "mix" sometimes when the varieties are planted half a mile apart on the grounds of different owners. It will adapt itself to climates with astonishing facility. Corn of the north, planted in the south to obtain more rapid maturity, will, in the second year be found to have largely adopted its new climate, and to have become slow in maturing. Taken from the south and planted in the far north, it will shorten its time of growing. An exception to this may, on the other hand, be found in the variety known as "sweet" corn, an important product for canning purposes. There are but two or three narrow districts where this variety

is a successful product for commercial purposes, considered as to quality and quantity, but chiefly as to the former.

There is a peculiar reason for the frequent and sometimes erroneous saying that "corn is the poor man's crop." It is invariably the first grown. He who hewed away the primeval forests in Ohio or Kentucky or southern Indiana always planted it first amid rocks, roots, stumps and brush-heaps with a hoe. The pioneer of the western prairies follows the breaking-plow, and puts in his first corn crop by cutting slices in the tough, upturned sods with an axe, putting into the gash his two or three grains, and pressing the edges together again with his foot. In either case if it grows the farmer lives. Often in the west it has provided both fire and food, since it made the bread, fattened the pig, fed the mule and cow, thatched the shed and was burned in the cooking-stove as a fuel far excelling even the best quality of coal, at a less price than either wood or coal.

In the raising of corn the usual ingenuity has been expended in providing machinery. The time of planting is brief, and by old methods the process was slow. The result has been a competition in devising means for a rapid and economical planting. At first the hoe was almost the only implement used in addition to the breaking-plow. Next it was found that by "laying off" the field by furrowing the broken soil both ways, the corn "dropped" by the hands of boys and women in the junction of the cross-furrows could be covered with a small plow, and could afterwards be cultivated on all sides by the same small plow. Then came the "corn-planter," in use now some twenty years, in the use of which the field was laid off only one way, and the machine, being driven across the field in the opposite way the corn was dropped by means of two valves, worked by two boys who rode upon the machine, in its proper place in the furrows as the "planter" passed over them.

Then came the "check-rower," being the above machine modified so as to dispense with the boys, the valves being governed by a long cord extending across the field, running through loops on the machine, and provided with knots at precisely equal distances, which knots were for the purpose of operating the valves as they successively passed a tripping device by the machine being driven forward. Complicated as this may seem in description, the check-rower is a practical machine still in use.

Other machines used in corn planting are really drills. There are a variety of ideas amongst corn raisers as to ways and modes, and a vast difference of opinion in the same neighborhood. Perhaps the drill mode of planting, placing the grains at intervals in a single row so that the growing crop can only be cultivated in one direction, is gaining ground. Without question, if only one grain is deposited in a place, and neither too far apart or too close together, the yield may be slightly greater and the back-breaking labor of "thinning" may be dispensed with. Intermediate between the check-rower and the drill-machine there is an extensive family of hand planters. The principle of construction of these is nearly the same in all. In one a handle is grasped in each hand. The planter makes a step forward, swinging the implement forward from its last position between his legs with the handles held apart from each other, and sticking the point of it into the ground in front of him with a smart blow, and immediately closing the handles together to drop the corn through the sliding valve into the ground. Another variety of the hand-planter has but a single handle, and is carried as a heavy walking-stick would

be. The great advantage of these simple and very cheap machines is that with them corn can be planted in any locality or situation, and replanting can be done where hills are missing, rapidly and effectively.

In cultivating the growing crop, an operation of the utmost importance, the hoe has become practically obsolete in all the great corn-producing regions. Here again the instinct of machine-making has had full scope. The cultivator is made to do the work. There is an immense variety of these implements, all operating upon one general principle, but differing largely in detail. One that is largely used permits the man to ride upon a kind of wooden saddle, with each foot inserted in an iron bracket or stirrup just above the blades of steel with which the ground is stirred close to the growing corn. By moving his feet he keeps the blades in the position he wishes, following all the sinuosities of the rows. The ancient prejudice against "easy farming" has rapidly gone by with the discovery that unnecessary hardship does not necessarily mean either virtue or profit. The agricultural umbrella has come into vogue, and reapers, mowers, and even sometimes the "cultivator" carry it over the farmer's head while he performs three or four times the work he could have accomplished by the ancient methods.

The great field for the perfecting of all modern methods has been the wide area of level virgin soil afforded by the Western States. It may be said without exaggeration that in that immense and fruitful region almost all old methods are obsolete. The machinery of agriculture, beautifully and cheaply constructed of steel, elaborately painted, handsomely proportioned, durable, economical and immensely profitable, has not even its feeble imitation in any other land.

Oats.—The oat (*avena sativa*) is a useful grain of wide geographical range and adapted to almost every variety of soil. It will flourish alike on sand or clay, will sustain itself on poor and rocky land and will grow luxuriantly on rich and well-cultivated fields. There are many varieties of this grain, differing in color of husk and kernel from white to black. This plant differs considerably in appearance from either wheat, rye, or barley. It grows in panicles, the calyx being two-valved or two-seeded; and seeds smooth and one-awned; the root annual; the stem growing from two to three feet high. The two glumes, or the chaff of the calyx, are nerved, pointed at the end, longer than the flower, and unequal. The two flowers and seeds in each calyx are alternate, conical in shape; the smaller awnless, the larger furnished with a strong, bent awn, of two colors. The branches of the panicle are erect when green, but droop as the seed ripens, from its weight.

The origin of the cultivated oat is generally believed to be *A. fatua*, L., or "wild oat." Prof. J. Buckman succeeded in raising "the potato-oat type" and "the white Tartarian oat" from grain of this species. Mr. A. Stephen Wilson, however, thinks that as yet there is no real proof of this relationship, because his own cultivation of the wild oat made no difference upon it; but there appears to be a great tendency in the oat to degenerate on stiff clay soils into "weed oats," a fact which may perhaps account for this divergence of opinion. Lindley had previously suggested that the cultivated oat was a domesticated variety of some wild species, and that it might not improbably be referred to *A. strigosa*, Schreb., "the bristle-pointed oat," which is the origin of the Scotch oat, according to Buckram. The white and black varieties of this species, Mr. Wilson observes, were cultivated in Eng-

land and Scotland from remote times, and "are frequently mentioned in Rogers' *History of Agriculture and Prices* . . . and they are still grown as a crop in Orkney and Shetland." Both these species are found in Europe, North Africa, Siberia, and northwest India. The "naked oat," *A. nuda*, L., is probably only a race of *A. sativa*; it was found by Bunge in waste ground about Pekin. Both this and the "common oats," *A. vesca*, are described by Gerard. Parkinson tells us that in his time (early in the seventeenth century) the naked oat was sown in sundry places, but "nothing so frequent as the common sort. The chief differences between *A. fatua* and *A. f.*, var. *sativa*, according to Buckram, are, that in the former the chaff-scales which adhere to the grain are thick and hairy, and in the latter they are not so coarse and are hairless. The wild oat, moreover, has a long stiff awn, usually twisted near the base. In the cultivated oat it may be wanting, and if present it is not so stiff, and is seldom bent. The grain is very small and worthless in the one, but larger and full in the other. Mr. Wilson adds that in point of attachment "in the wild oat the hanger terminates in a little oval spatula, . . . forming a kind of ball-and-socket connection, . . . In the cultivated oat the continuity of the vascular tissue in the hanger is not broken off by any point of the kind." There are now many varieties of the cultivated oat. With regard to the antiquity of the oat, De Candolle observes that it was not cultivated by the Hebrews, the Egyptians, the ancient Greeks, and the Romans. Central Europe appears to be the locality where it was cultivated earliest, at least in Europe, for grains have been found among the remains of the Swiss lake-dwellings perhaps not earlier than the bronze age, while Pliny alludes to bread made of it by the ancient Germans. Pickering also records Galen's observations, that it was abundant in Asia Minor, especially Mysia, where it was made into bread as well as given to horses; he also states that ten varieties were introduced by Mohammed Ali into Egypt, for fodder, and that it was seen by Bruce wild in Abyssinia, sometimes tall enough to conceal horse and rider. And he adds that eastward from Syria it is called "sulu" by the Tartars, and was observed by Kaempfer and others in Japan; that it was brought over by colonists, and is now cultivated in northeast America; and that it has now become naturalized in parts of South America.

Oats are sown from April until the beginning of June, the usual seeding being from two to four bushels per acre according to the soil. The plant is hardy and the earliest sown is generally the heaviest and most productive. An acre of good land will yield forty bushels, and on rich soils still better results are obtained. The seed should be harrowed in and rolled, and except for weeding and protection against the wire-worm the crop requires little attention until harvest-time. The proper time for harvesting is a matter requiring experience and judgment. Oats often ripen very unevenly, they are much subject, from the weight of the heads, to becoming laid by rain or a heavy wind, and if permitted to become over-ripe they shed in the field to the manifest loss of the farmer. The oat is sufficiently matured for harvesting after it has passed the milk stage, when the lower part of the stalk begins to assume a yellow color. When cut at this time the straw is at its best for fodder, the grain is full and the husk light. It sometimes becomes necessary, owing to bad weather and the laying of the crop, to cut the entire produce for use as forage, but this, from its tendency to bloat the animals if used damp, should only be fed sparingly to stock. Oats are principally used for horse feed and enter into the food of man in this country only in the form of oatmeal.

Besides a large quantity of starch—about 65 per cent.—and some sugar, gum, and oil, the grain of oats contains almost 20 per cent. of nitrogenous principles, or proteine compounds, of which about sixteen or seventeen parts are *avenine*, a substance very similar to *caseine*, and two or three parts gluten, the remainder albumen.

Were it not for the extensive growing of corn in the United States it is likely that the growing of the oat would occupy a more prominent place than it now does. Nearly every American farmer has of it what he calls a "patch," that is from four to ten acres. But except in particular places he does not go into it extensively. It cannot be fed to swine. Its use for human consumption is limited in America to the crushed grain known as "oatmeal," an universal breakfast-dish. In other countries, and largely here, it is regarded as *par excellence* the food for horses. Yet unquestionably some of the best horses ever produced here have been reared upon corn. During the working season the horses of the American farmer, the western farmer at least, are fed upon corn, there being a well-founded idea that it is "stronger" food, as well as cheaper. The oat seems to be chiefly grown to fill out the odds and ends of rural economy, and when raised as a selling crop goes chiefly to the owners of city teams, where, unquestionably, it is indispensable.

The yield in this country is much oftener under than over 3½ bushels to the acre. To be successful it must be sown very early, the long seasons of the Southern and Middle States seeming to make little difference in this respect. When heavy enough to yield even 35 bushels there must necessarily have been an early and favorable spring, and when the promise is thus large a not severe winter, accompanied by a little rain causes the crop to "lodge" so badly that only the mowing-machine and the rake can be brought into requisition to partially save the crop.

The machine used in growing oats is precisely the same with that used in the cultivation of wheat.

Barley (*Hordeum*), a cereal or grass crop. In ordinary cultivation it is annual, but some hardy varieties are sown in autumn, and except in severe winters, survive and ripen the second year, or if frequently cut green and not allowed to mature seed, may continue to grow for several years. It is better adapted than any other grain to the most northern regions of the grain-growing belt. Some of its varieties are cultivated with advantage where the climate is too cold, or the summer too short, for any other cereal crop. It extends over a wider climatic range than any of the other grains. Barley-meal is used for bread in the north of Europe, but in other parts it is used as a horse-corn, or converted into malt for the making of beer, or deprived of its outer husky covering, and so used as an article of human food called *pot-barley*, or when well-rounded and polished in the mill, *pearl-barley*; this is sometimes ground into a fine quality of barley-meal. Barley has generally a more slender seed than that of wheat, and a firmer and rougher covering of husk or chaff. It has also a longer awn or beard. Its amount of starch is about the same as that of wheat, some analyses showing it to be greater, and others less; but its amount of gluten is less. It contains also several per cent., ordinarily from six to eight, of uncombined saccharine matter.

By botanists cultivated barley is divided into three species. *H. vulgare* (Scotch Bere or Bigg) is distinguished by having the grains in four rows; *H. hexastichum* in six rows; and *H. disticum* in two rows. But the lower part of the spike in the varieties ranked under *H. vulgare* is often six-rowed, and only the upper part

four-rowed; and in rich soils a tendency to resume the six-rowed forms is otherwise manifest. A kind with naked seeds, called Siberian Barley (*H. caeleste* of some writers), is cultivated in some parts of Europe, but it is liable to loss in harvest through the grain, which is slightly attached to the straw, shaking off; its straw is regarded as richer food for cattle than that of most other kinds. The Nepal or Himalaya Barley, another variety with naked seeds, has been recommended as particularly adapted for cold mountainous regions, yielding good crops in the Himalaya at an elevation of 14,000 feet above the sea. Of the two-rowed barley there are many varieties, of which the common or Early English, Golden Drop, Big Ben, Hallett's Pedigree, and the Chevalier are among the most esteemed, the latter being in particular demand for brewing. The Sprat or Battledore Barley (*H. zeocriton*) is also two-rowed, but is distinguished by the grains standing out from the spike, their awns spreading very widely. It is sometimes called German Rice, as it swells by boiling in the way that rice does, and for some purposes forms a good substitute for it. It is in much esteem in Germany, and succeeds well in the Alps at an elevation of 3,360 feet. Barley is most productive where the climate is moderately dry and warm. In former times this grain was largely employed in the British Islands as human food; and is still used in some parts of Ireland, and in the Highlands of Scotland. Fine malting barley always commands a ready demand in the market, as well as a high price.

None of the above-named varieties are specifically known in the United States. In the West, barley takes third or fourth place among crops. Where cheap transportation facilities exist, and where for some reason peculiar to the locality it is a profitable crop, barley is a prominent product. Its use for horse-feed is limited in this country, and as food for man it may almost be said to be unknown except in the form called "pearl-barley," which is a breakfast dish, manufactured as a specialty, and sold in measured packages as such. There is now a growing disposition on the part of brewers to discard barley as the indispensable grain in making beer, and to use corn instead. Under improved processes the beverage is probably as good when one is used as it is with the other, and one of the traditional uses of the grain is thereby abolished.

Barley occupies a prominent place in the rotation of the lighter class of arable lands. Barley will grow on a lighter soil than is needed for the successful production of wheat, but whatever the soil may be, good drainage is indispensable. It comes to the greatest perfection on mellow, rich loam. Barley must be sown early in spring, and flourishes on good clover or grass lay, turned down the preceding fall. Clean, well-manured land, which has been cropped to clover, is also very suitable for this grain. The allowance of seed ranges from two to three bushels to the acre, and good judges prefer the minimum allowance. Careful preparation of the soil is necessary and the seeding should be followed by harrowing and rolling. It is not desirable to apply fresh manure direct to this crop. Unless great care is exercised in the selection of clean seed, barley is apt to be infested by weeds and will require the vigorous attention of the farmer during the whole period of its growth. The plant, when it grows luxuriantly, is very apt to become laid by rain and to shatter and waste in the field.

Considerable judgment must be exercised in regard to the proper time of harvesting this grain. If left too long a severe loss will be entailed, while if cut prematurely the ears will be shriveled and poor.

Barley contains, on an average, about 65 per cent. of nutritive matter, while wheat contains about 78 per cent. The comparative value of wheat, barley, and oats, for feeding stock, may be represented by 47, 32, and 24, taking the same quantity of each. The soil on which these grains are cultivated has, no doubt, much to do with their composition.

Rye (*Secale*), a genus of grasses, allied to wheat and barley, and having spikes which generally consist of two-flowered, rarely of three-flowered, spikelets; the florets furnished with terminal awns, only the upper floret stalked. One species (*S. cereale*) is a well-known grain. It has, when in fruit, a roundish-quadrangular spike, with a tough rachis. Its cultivation does not extend so far north as that of barley; but it grows in regions too cold for wheat, and on soils too poor and sandy for any other grain. Its ripening can also be more confidently reckoned upon in cold regions than that of any other grain. But rye succeeds best, and is most productive in a climate where wheat ripens. It is extensively cultivated in the Middle Atlantic and Northeastern States, in Ohio and Michigan, and other Western States. Rye grows best on a rich, sandy loam, but it will flourish on light soils not adapted to other white crops. The soil should be prepared for rye in the same manner as for wheat. It will do well on an old turf or clover lay, and is a good crop to follow roots on well-cleaned and well-manured lands. There is but one species of rye used as grain, but this is divided into two varieties, known as spring and winter rye. Winter rye is sown late in August or early in September, from one to two bushels of seed per acre being used, according to the quality of the soil. Except for harrowing and rolling in the spring no after-cultivation is necessary, but weeds should be kept down and it is almost impossible to damage this crop by cultivation. Rye is seldom attacked by insects or vermin, but is subject to a fungoid growth known as "ergot" or "cockspur," which renders it poisonous alike to man and animals. Rye should, like wheat, be harvested early. It is sometimes grown as a forage crop. The grain is largely used for bread-making in connection with wheat, flour or cornmeal, and is a favorite with Germans and other foreign-born citizens. The grain or kernel of rye is smaller in size than that of wheat. It tillers much less in growing, and its straw, or stem, when ripe, is very rich in silica; more so than that of wheat, while it contains a larger percentage of potash and phosphoric acid than the latter. Manures containing a large amount of phosphates and silicates of potash would seem, therefore, to be highly important for rye, as, indeed, they are for all the cereals.

Rye straw, though of little value for fodder, is in great demand for litter, and for various mechanical purposes, and commands a high price. But it is as a fodder-plant, and particularly for soiling in early spring, that it is now extensively used and highly prized. For this purpose it is sown in the autumn, the earlier the better, after other crops come from the ground, and in early spring it starts up luxuriantly, and is fit to be fed off by sheep and lambs, or to cut at the height of six inches. At this stage of its growth, and before it begins to spindle, it is succulent and nutritious; but as soon as this period of its growth is reached, it loses its succulent qualities, and is no longer relished by stock.

Over the greater portion of the great agricultural region west of the Mississippi, the use referred to above, as a forage crop, or pasturage, is almost the only one to which rye is put. Sowed broadcast in the fall, and pastured during the winter and in early spring,

it becomes a valuable adjunct to stock-raising by affording to young animals, and those weakened by the winter, an absolute necessity for life and growth. Under these circumstances it is commonly known as "rye-pasture," and a larger return is obtained from it than could possibly be from the matured and harvested grain.

As food for man, its use is practically unknown in America. Corn has supplanted it in this respect, and this fact will probably remain unchanged. The same may be said of it as horse feed. Wherever grown extensively, which is only in limited districts, its destined use is for the manufacture of whisky. For this it possesses special qualities, though nearly all the whisky now distilled and distinctively known as "old rye," has had a good proportion of corn in its original composition, in mixtures and proportions only known to experts in the economics of the distillery.

Buckwheat (*Fagopyrum esculentum*, or *Polygonum fagopyrum*) is a native of the basin of the Volga, the shores of the Caspian Sea, and many parts of Central Asia. A recent German authority affirms that there is no authentic mention of it until 1436, at Mecklenburg, whence it spread over Europe in the following century. It is also said to have been introduced by the Moors into Spain, and thence to have extended over Europe, or, again, to have been brought to Europe by the Crusaders. The French name *Sarrasin* seems to support these latter traditions. It is cultivated on account of the farinaceous albumen of its seeds, which are used, as grain, for food of man and cattle. It is upright, branched, one to three feet in height; the leaves are between heart-shaped and arrow-shaped, the flowers pale red, the seed (nut) black and triangular, its angles entire. The resemblance of this seed in form to the beech-nut is supposed to be the reason of the German name *Buchweizen* (lit. "beech-wheat"), from which the English name is derived. Buckwheat is a very common crop in some parts of Europe and the United States of America. In Northeast Germany and also in Brittany, buckwheat is valued as a crop, particularly for sandy heaths, moorlands, and other poor soils. It yields abundantly and requires little manure or attention. Forty bushels or more per acre may be expected, weighing forty-six or forty-eight pounds per bushel; and notwithstanding the resemblance of the seed to grain in its qualities and uses, wheat or any other cereal crop generally succeeds well after buckwheat. The seed is most frequently used in the shape of groats, or made into pottage; in the United States, thin cakes of the flour are a standard food. It is very nutritious, containing about 10 per cent. of gluten and 52 per cent. of starch, besides about 6 per cent. of gum and sugar. It is said to be as good as barley for fattening cattle, and better for horses than oats. But as the seed is covered with a very hard rind or thin shell, it must always be shelled before being given to cattle. Poultry are very fond of it. Beer is sometimes brewed from it, and it yields a spirituous liquor of good quality; indeed it is frequently used in gin-distilleries. As green fodder, the herbage of the plant is said to be more nutritious than clover; but it is said to act as a narcotic on sheep. Bees delight in its flowers, and in some parts of the United States it is sown on this account. The seed is usually sown broadcast over the land, which has been plowed in autumn or early spring, and well scarified or harrowed. About a bushel and a half of seed per acre is required when sown broadcast, but a bushel is sufficient if drilled with a machine. In the latter case it should not be

sown in narrower drills than one foot apart, but two feet is recommended as being better for the succeeding crop, as the wider intervals can be properly cultivated. It should not be sown before the middle of May, as the last frost is injurious. When the lower seeds are ripe it should be mown, as they are easily shed out if allowed to stand too long. Tartarian Buckwheat (*F. tataricum*) is distinguished by the toothed edges of the seeds and its more vigorous growth. It is hardy, and adapted for cold situations; but yields inferior meal, and is reckoned a mere weed in Germany. In Canada, on the other hand, it is much grown; but its use, as well as that of common buckwheat, is thought by many to induce skin disease. *F. emarginatum* is cultivated in China.—Dyer's Buckwheat is *Polygonum tinctorium*.

Buckwheat is, in the United States, another of the numerous "patch" crops. Four or five acres of it will suffice for the supply of an entire rural neighborhood. As a food for animals it has never been adopted, and in the farther West there are many farmers' sons who have never seen it growing. Like oatmeal, its preparation for use in making buckwheat cakes is a specialty, and it is a common grocery supply in small quantities and in convenient packages.

Where, in a special locality, the keeping of bees has become an industry, the sowing of buckwheat is practiced for the sole purpose of pasturage for the bees. The flavor given to the honey by even a wild variety of the plant, or at least a plant of the family which is known by that name, is inimitable. Wherever there is a patch of buckwheat in blossom it will be found to be swarming with bees who have probably come several miles to reach it.

THE LEGUMINOUS PLANTS.

Bean is a term used to designate the seeds of various plants, but is generally applied to those of different species belonging to the natural order Leguminosæ, as, for instance, the Common Bean (*Faba vulgaris*), the French, Kidney, or Haricot Bean (*Phaseolus vulgaris*), the Molucca Bean (*Guilandina b. nudicella*), the Locust Bean (*Ceratonia siliqua*), the Tonka Bean (*Dipterix odorata*), and others. The term is also applied to the seeds of other plants widely different from each other and from the Leguminosæ. Of these, the Pitchurim Bean, the seed lobes of *Nectandra puchury*, a relative of the Cinnamon and a native of tropical South America; St. Ignatius' Bean, the seed of *Ignatia amara*, closely allied to *Strychnos*, the source of strychnia, and itself strongly impregnated with the deadly qualities of that drug; the Egyptian or Sacred Bean, the seed of *Nelumbium speciosum*, an aquatic plant held in veneration by eastern peoples, and the remarkable Calabar Bean, *Physostigma venenosum*, are a few of the many instances of plants whose seeds are popularly designated beans.

The common bean is a valuable source of food to man and animals in most of the temperate climates of the globe. It is of eastern origin, and was cultivated by the Egyptians, the Greeks and the Romans, who introduced it into Great Britain. The varieties are numerous, several of them being adapted to field cultivation. It is used as human food in this country in both the green and ripe state, and the ripe beans are valuable, though little used, as food for pigs, horses and cattle. The Greeks and Romans looked upon it as in some respects a sacred plant; in the Roman festival of Lemuralia the father of the family threw black beans over his head, repeating certain traditional words. Pythagoras forbade his disciples to eat beans.

Beans were used by the ancient Greeks and others in voting by ballot, and a survival of this custom has lingered in the election of kings and queens and Twelfth Night and other feasts.

Beans of the ordinary kind belong to one species, *Faba vulgaris*, natural order Leguminosæ. Beans hardly come under the designation of "crops" in the United States. Many varieties, known principally by names entirely local, are grown in kitchen gardens as a family supply, and these are chiefly used in the green state, while still young. Beans grow best on the heavier classes of soils, and are usually planted after wheat or some other grain crop. The most common method of preparing the land is to plow in farm-yard manure early in autumn. The common concentrated manures, other than potash, give as a rule poor results. The seed, two bushels to two and one-half bushels per acre, may then be drilled, or sowing may be delayed till spring, when the land is found to be mellowed by the winter frosts; three bushels to three and one-half bushels of seed is then required of some spring-sown variety; three inches is a good depth for winter planting, and two inches in spring; eighteen inches is a convenient distance between the rows, allowing space for thorough horse-hoeing and hand-hoeing, which is necessary, as the bean is a dirty crop. Beans may be broadcast and covered easily by harrowing, but the system, although simple, is objectionable, because the land cannot be properly cleaned when the crop is growing, and rather more seed is necessary. Sowing may be done every second furrow while the land is being plowed. This system is well suited to planting beans in autumn on land being broken up from grass. Autumn-sown beans grow the heaviest crop, if they escape severe winter frosts or frequent sudden changes of temperature, which is apt to kill them; spring-sown beans are rather later in coming to maturity. Ripened beans are ground into bean-meal, used as food for horses and cattle, and sometimes made into coarse bread. Beans take longer to dry after being put into sheaf than cereal crops, but are not so easily injured by bad weather; they are stacked in the same way as wheat, openings being left through the stacks for ventilation, to prevent molding and injury to the seed. Beans are liable to be attacked by mildew when grown under unfavorable circumstances. At times a fungus appears in the form of discolored patches on the leaves and pods. If these diseases are largely developed, the crop is best plowed down as a green-manure after being laid by rolling.

There are three varieties of field, or bush, bean usually cultivated in the United States. The *small white* is most commonly grown. It is the most prolific, bearing the closest culture, and keeps longest on sea voyages. The *kidney*, or long white, is much larger and of better edible quality, requiring a longer time to mature, with a ranker growth; and the *marrow*, with a large round kernel, and of equally good edible quality as the kidney, requiring the same time to mature. These two last are usually worth full 25 per cent. more in the market than the small white, on account of their superior excellence for table use.

Peas.—This variety of the *Leguminosæ* is valuable not only for the table but as food for domestic animals. In European countries, especially in the poorer ones, pea-meal is used for the manufacture of bread or a substitute for it in the shape of cakes or "bannocks." Often it is mixed with barley-meal, as in Scotland, and sometimes with wheat or rye flour. In this country, except for table use in the green state, peas are solely used for feeding the lower animals. A soil similar to that which grows good wheat

is best for peas, but they will grow well on strong clays and on any well-manured land. Peas should be sown on a clean fallow, or a newly-harrowed rich sod. From two to three bushels of seed to the acre is used and sowing is usually broadcast, although for the purpose of keeping the field clear of weeds the system of sowing in drills is much preferable. The seed should be plowed in and the ground well-rolled. The plant is very much exposed to the attacks of insects, of which the pea-bug is the most destructive, but the ravages of this insect can be avoided by late sowing, careful selection of seed and the application of various preparations to the seed. Peas should not be harvested until fully ripe, but if too long time is allowed there is great waste from the bursting of the pods. Much of this waste, however, can be saved by turning swine into the fields after the harvest. The haulm can be used for fodder. In the Southern States the cow pea is grown extensively for forage.

Millet.—This is usually classed by the American farmer as among his grasses, grown, cut, stocked and exclusively used, as hay. It has grown greatly in importance in the last twenty-five years, growing luxuriantly on the soil of all the Western States, cheaply grown and cured, and yielding largely what is universally classed as "feed." The yield should be four tons to the acre, sometimes running as high as seven tons. Its value as stock feed unquestionably lies in its seeds. Seed-grasses, such as "timothy" and clover, do not grow readily on new soil, and are difficult to set. The native grasses, growing naturally and luxuriantly, are very valuable both for pasturage and hay. But they are not, strictly speaking, seed-grasses, and lack precisely that value in the sustenance of cattle. Millet supplies this want.

There are two general varieties in common use; one being called the small or "common" millet, the other being "giant" or "mammoth," according to locality. The smaller variety is the more common, because the more easily handled. It is cut when "in the milk" to prevent seed waste.

Nevertheless, there are notions which verge upon superstition among farmers in regard to the feeding of millet to stock, especially to cows. One of these is that it dries up the milk; that is, that like pumpkin seeds, it seriously affects the milk-secretion of cows that eat it. Another is that it may produce abortions. Still another is the belief that it is apt to produce the condition called "founder." Doubtless all these things have happened in connection with millet as a feed and with more frequency than where animals were given a lighter diet. But it is much more probable that the troubles arose from careless feeding and quantity than from anything inherent as a quality in the food itself. The difficulty in feeding to sheep from a rack is a mechanical one. The small seeds fall from above into the creases and folds of a Merino sheep's neck, and become embedded in the fleece.

GRASS AND FORAGE CROPS.

Grasses form the order Gramineæ, which with Cyperaceæ (Sedges) makes up the second great division (Glumaceæ) of Monocotyledons. The first division (Petaloidæ) consists of orders whose flowers are of the liliaceous or orchidaceous type; while the flowers of Glumaceæ are best described as "grassy." The following characters are sufficient to distinguish grasses from sedges; grasses have generally cylindrical or compressed jointed stems, usually with internodes becoming hollow; leaves alternate with sheath clasping the stem, but edges of sheath not joined; em-

bryo at one side of the base of the endosperm (albumen). Sedges have generally triangular, sometimes cylindric, stems, jointed but solid, leaves in three vertical rows with leaf-sheath entire and forming a hollow cylinder round the stem; embryo within the base of the endosperm. The term "grass" is often applied to any herbaceous plant that helps to form pasture, and agriculturists speak of natural and artificial grasses, the former only belonging to Gramineæ. Cereals and some pasture grasses are annual, but most pasture and woody grasses are perennial. Cereals and pasture grasses are herbaceous; bamboos are woody and may grow to a height of 100 feet in one season. There are 250 genera of grasses, and 3,200 distinct species; of these 41 genera with more than 100 species are natives of the British Isles, and fully 800 species and varieties are natives within the limits of the United States.

Description.—The leaves are long and tapering, one being given off at each node of the stem; the leaf-sheath is a modified stalk, and is often prolonged upward for a short distance beyond its junction with the blade, into a membrane or ring of hairs (ligule), which forms a collar round the stem. The parallel veins of the leaves are continued downward into the stems and anastomose only at the nodes. The stem (culm) at first consists of solid nodes and internodes, but the internodes, except in sugar-cane and a few other tropical grasses, become hollowed out, and thus the stem is rendered comparatively lighter, and at the same time better able to resist the lateral pressure of the wind; because a cylinder offers more resistance to pressure than does a solid rod of the same weight and kind of material. The stems of grasses are further strengthened by impregnation with silica. Annual grasses have tufted, fibrous roots, but most grasses perennate by means of solid underground stems (rhizomes), from the nodes of which roots are developed; roots also grow freely from the lower nodes of the aerial stems of all grasses. The flowers are mostly hermaphrodite, as in barley and oats; maize and a few others are monœcious; and some of the fescue tribe have the lower hermaphrodite and the upper male. Each flower is inclosed by two bracts (paleæ), which are the homologues of the two spathe-like bracts in the inflorescences of Iridaceæ. The posterior bract is two-nerved, indicating its two-fold nature, and often clasps the fruit when mature; the anterior ("flowering glume") surrounds both, and sometimes bears an awn, as in barley. A number of flowers may be crowded together to form a spikelet; and, further, a number of such spikelets may be attached by stalks to a central axis, forming a raceme, as in *Melica nutans*; when the raceme is loosely branched, the inflorescence becomes a panicle, as in oats; or the spikelets may be sessile on a central axis, forming a compound spike, as in rye-grass. The spike may be looked on as a reduced raceme or panicle, in which the stalks of the spikelets have not been developed; each spikelet may again be reduced to a single flower, and then a simple spike like that of mat-grass (*Nardus stricta*) is the result. Beneath the lowest flowers of many spikelets there are two bracts (glumes) which may or may not bear barren flowers in their axils. There is no perianth such as is found in most insect-pollinated flowers. Grass flowers are wind-pollinated and generally inconspicuous; in some, however, there are two or rarely three scales (lodicules) within the flower bracts; and these, from their position and relation to the other parts of the flower, may be regarded as segments of a rudimentary perianth. These scales, becoming turgid at the period of sexual maturity,

press the anterior bract outward, and expose stigmas and stamens for pollination. Should wet weather occur when this stage is reached the powdery pollen may become clogged and kept from being blown about; thus preventing fertilization and the opportunity of producing seed.

Stamens vary from six or more to one; in British grasses usually three, but three to one in the fescue tribe. The slender filaments are inserted at the bases of the anthers, but the anther lobes grow downward below the point of insertion, and the anthers appear to be, but are not, versatile. The ovary is one-celled; there are three or two styles, with long and hairy, or short and feathery stigmas, which are thus enabled to catch the wind-borne pollen. The fruit is one-seeded (*caryopsis*); the seed is adherent to the pericarp. The embryo by the great development of the farinaceous endosperm is displaced to one side at the base of the latter, its surface of contact being confined to that of a large process of disputed homology, the scutellum. When a grain of wheat or other grass begins to germinate, the scutellum acts as a placental surface to the embryo, digesting the substance of the endosperm, and passing it on in a soluble state to the embryo, which soon begins to develop roots and leaves. When all the endosperm has been used up the seedling grass has put forth roots enough to draw a sufficient supply of sap from the soil, and green leaves to transform the sap into food materials for the tissues of the plant. The scutella of grains may be compared to the suckers (haustoria) of mistletoe, for it is by means of suckers that plant parasites fix upon, and draw sap from, their hosts.

Classification.—The order is divided into two divisions, the divisions into tribes, genera, and species. The genera are omitted here, and only the better-known species are given as examples. (a) *Panicæ*—Spikelets articulate with the pedicels below the lowest glume, with a single terminal fertile flower, while the lower inferior is male or sterile.

Tribe.	Examples.
PANICÆ.....	Panicum; Setaria.
MAYDÆ.....	Job's Tears (Coix); Maize (Zea).
ORYZÆ.....	Rice (Oryza); Cut Grass (Leersia).
TRISTEGINÆ.....	Arundinella.
ZOYSIÆ.....	Tragus.
ANDROPOGONÆ.....	Sugar-cane (Saccharum); Durra (Andropogon); Millet (Sorghum).

(b) *Poaceæ*.—Spikelets usually articulated above the lowest glume, 1—or many flowered; male or imperfect flower above the fertile ones.

Tribe.	Examples.
PHALARIDÆ.....	Reed Canary Grass (Phalaris); Sweet Vernal Grass (Anthoxanthum); Fox-tail Grass (Alopecurus).
AGROSTIDÆ.....	Millet Grass (Millium); Timothy Grass (Phleum); Bent (Agrostis).
AVENÆ.....	Hair Grass (Aira); Soft Grass (Holcus); Oats (Avena).
CHLORIDÆ.....	Dog's-tooth Grass (Cynodon); Eleusine.
FESTUCÆ.....	Reed (Phragmites); Dog's-tail Grass (Cynosurus); Cock's-foot Grass (Dactylis); Melic Grass (Melica); Quaking Grass (Briza); Poa; Fescue; Bromus.
HORDEÆ.....	Rye (Secale); Rye-grass (Lolium); Wheat (Triticum); Barley (Hordeum); Mat Grass (Nardus).
BAMBUSEÆ.....	Bambusa; Arundinaria.

Distribution.—Grasses are the most universally diffused over the globe of all flowering-plants. There is no district in which they do not occur, and in nearly all they are a leading and dominant feature of the flora. In actual number of species *Gramineæ* comes considerably after *Compositæ* and *Leguminosæ*, the two most

numerous orders of phanerogams, but in number of individual plants it probably far exceeds either; while from the wide extension of many of its species, the proportion of *Gramineæ* to other orders in the various floras of the world is much higher than its whole number of species would lead one to expect. This number can, however, scarcely be put much below 6,000, which is probably somewhat more than a fifth of all monocotyledons. This is about one-twentieth of the phanerogams as a whole, yet in any given locality, with a few exceptions, this proportion is largely exceeded. In tropical regions, where *Leguminosæ* is the leading order, grasses closely follow as the second, while in the warm and temperate regions of the northern hemisphere, in which *Compositæ* takes the lead, *Gramineæ* again occupies the second position. As the colder latitudes are entered the grasses become relatively more numerous, and are the leading family in Arctic and Antarctic regions. The only countries where the order plays a distinctly subordinate part are some extra-tropical regions of the southern hemisphere, Australia, the Cape, Chili, etc. The actual proportion of graminaceous species to the whole phanerogamic flora in different countries is found to vary from nearly one-fourth in the Arctic regions to about one-twenty-fifth at the Cape; in the British Isles it is about one-twelfth. The following are proportions per cent. in various floras, from Decandolle's *Geogr. Botanique*, which must, however, be taken as merely approximations in most cases:

In the tropics: Cape Verd Islands, 13; Abyssinia and Nubia, 12; Mexico, 10; Hawaiian Islands, 10; Congo, 8; Mauritius, 8; neighborhood of Quito, 10; Barbadoes, 6; Surinam, 6; Tunis, 6; New Guinea, 4; New Grenada, 5. In temperate regions of the northern hemisphere: Banda and some other districts of India, 15 to 17; Egypt, 12; Texas, 12; Azores, 12; Madeira, 11; Algeria, 9½; Canaries, 8; United States, 8; Sardinia, 9; Holland, 10; Sweden, 8½; Great Britain, 8½; France, 7½; Germany, 7; China, 8; Altai, 5½; Japan, 5½. In northern regions (beyond 60° N. lat.): Melville Islands, 21; Spitzbergen, 18; Iceland, 11. In extra-tropical regions of the southern hemisphere: Chili, 6; Cape Colony, 4½; Swan River district, 2. In Antarctic Islands: Kerguelen, 25; Tristan da Cunha, 15.

The principal climatic cause influencing the number of graminaceous species appears to be amount of moisture; it is only in very dry countries that they become distinctly less numerous. A remarkable feature of the distribution of grasses is its uniformity; there are no great centers for the order, as in *Compositæ*, where a marked preponderance of endemic species exists; and the genera, except some of the smallest or monotypic ones, have usually a wide distribution. Speaking generally, however, the *Panicææ* are tropical and warm temperate plants, while the grasses of temperate and colder regions are members of the *Poaceæ*. The former are very sparingly represented in Europe by a few species of the vast tropical genera *Andropogon* and *Panicum*. *Poaceæ*, on the other hand, form a fair proportion of tropical *Gramineæ*, especially in the higher districts where, as in the mountains of Abyssinia, are several endemic genera and many species. The largest tropical genus of *Poaceæ* is *Eragrostis*.

The distribution of the tropical tribe *Bambusæ* is interesting. There are 170 or more species, which are about equally divided between the Indo-Malayan region and tropical America, only one species being common to both. Apparently there is but a single native species on the African continent, where it has a wide range, and none are recorded for Australia, though species may perhaps occur on the northern coast. One species of *Arundinaria* reaches north-

ward as far as Virginia, and the elevation attained in the Andes by some species of *Chusquea* is very remarkable,—one, *C. aristata*, being abundant from 15,000 feet up to nearly the level of perpetual snow.

Many grasses are almost cosmopolitan, such as the common reed, *Phragmites communis*; and many range throughout the warm regions of the globe, e. g., *Cynodon Dactylon*, *Eleusine indica*, *Imperata arundinacea*, *Sporobolus indicus*, etc., and such weeds of cultivation as species of *Setaria*, *Echinochloa*, which are found over both Old and New Worlds. The recent masterly revision of the whole of the Australian species by Bentham well exhibits the wide range of the genera of the order in a flora generally so peculiar and restricted as that of Australia. Thus of the ninety indigenous genera (many monotypic or very small) only fourteen are endemic, one extends to South Africa, three are common to Australia and New Zealand, eighteen extend also into Asia, while no less than fifty-four are found in both the Old and New Worlds, twenty being chiefly tropical and twenty-eight chiefly extra-tropical.

Of special remarkable species *Lygeum* is found on the sea-sand of the eastern half of the Mediterranean basin, and the minute *Coleanthus* has only occasionally occurred at intervals in three or four isolated spots in Europe (Norway, Bohemia, Normandy). Many remarkable endemic genera occur in Tropical America, including *Anomochloa* of Brazil, and most of the large aquatic species with separate sexes are found in this region. The only genus of flowering plants peculiar to the Arctic regions is the beautiful rare grass *Pleuropogon Sabini*, R. Br., of Melville Islands.

Of the grasses, natural and artificial, grown in the United States, the first place must properly be given to the indigenous timothy, or cat-tail (*Phleum pratense*). It attains to perfection on rich clays and loams in the Middle States and yields under favorable circumstances a ton and a half to two tons of hay per acre. It is a hardy grass, of luxurious growth, and its nutritive qualities are universally recognized. It is also a valuable crop for seed, an acre of prime grass yielding from fifteen to twenty-five bushels of clean seed, which is usually worth in the market from \$2 to \$4 per bushel, and the stalks and chaff that remain make a useful fodder for most kinds of stock. It may be sown on wheat or rye in August or September, or in the spring. When sown alone or with other grasses early in the season on a rich soil, it will produce a good crop the same year. From its late ripening it is not advantageously mixed with clover unless upon heavy clays which hold back the clover. It has been tried with the northern or mammoth clover on clay, and the latter, though mostly in full blossom, was still pushing out new branches and buds when the former was fit to cut. The quantity of seed required per acre depends somewhat on the soil and its condition. Eight quarts on a fine mellow tilth is sufficient, and is equal to sixteen on a stiff clay.

The blue-grass of Kentucky, otherwise known as June grass, is an early grass, very common in the soils of New England and the West, in pastures and fields, constituting a considerable portion of the turf. It varies very much in size and appearance, according to the soil on which it grows. In Kentucky it is universally known as blue-grass and is considered the most valuable of all the pasture grasses. It comes into the soil in some parts of the country when left to itself, and grows luxuriantly and is relished by cattle. Its creeping root is said by some to impoverish the

soil. In practice blue-grass is a pasture grass entirely, and is never cut to be cured as hay. It is what may be termed a winter grass, being of little value for pasture in the heats of summer. When it remains unpastured during these hot months it springs up and grows luxuriantly in the moisture and coolness of the fall, and lies down upon the ground in a dense mass. Then, even in midwinter, animals of all the grass-eating families learn to scrape the snow aside, and eat the green below to the bottom. In the fall, when all other pastures are brown, it is green and luxuriant. All American lawns are of this same blue-grass, and the first of all the greenness of the spring is this even and luxuriant carpet. It produces but one flowering stem in a year, while many of the other grasses continue to shoot up flower stalks and run to seed through the season. On this account it is recommended highly for lawns, where uniformity is desired. The produce ordinarily is small, compared with other grasses, but the herbage is fine. It grows well in rather a dry soil, but will grow on a variety of soils, from the driest knolls to a wet meadow, but does not withstand our severe droughts as well as some other grasses. It endures the frosts of winter better than many other grasses; and in Kentucky, where it attains the highest perfection as a pasture grass, it sometimes continues luxuriant through their mild winters.

Meadow foxtail is a valuable pasture grass, on account of its early and rapid growth, and of its being greatly relished by stock of all kind. The stems and leaves are too few and light to make it so desirable as a field crop. It thrives best on a rich, moist soil, and shoots up its flowering stalks so much earlier than timothy, that it need not be mistaken for that grass, though at first sight it closely resembles it. It is superior to timothy as a permanent pasture grass, enduring the cropping of sheep and cattle better, and sending up a far more luxuriant aftermath.

The nutritive qualities of meadow foxtail are most abundant at the time of flowering. It is said to lose upward of 70 per cent. of its weight in drying, if cut in the blossom.

The seed of meadow foxtail is covered with the soft and woolly husks of the flower, while the larger glume is furnished with an awn. There are five pounds of seed in a bushel, and 76,000 seeds in an ounce. An insect attacks the seed while it is forming, and it is also subject to blight; and hence good seed is somewhat difficult to procure, and is held at a high price.

Orchard grass is one of the most valuable and widely known of all the pasture grasses. It is common to every country in Europe, to the north of Africa and to Asia, as well as to America. Its culture was introduced into England from Virginia, where it had been cultivated some years previously, in 1764. It forms one of the most common grasses of English natural pastures, on rich, deep, moist soils. It became, soon after its introduction into England, an object of special agricultural interest among cattle-feeders, having been found to be exceedingly palatable to stock of all kinds. Its rapidity of growth, the luxuriance of its aftermath, and its power of enduring the cropping of cattle, commend it highly to the farmer's care especially as a pasture grass.

As it blossoms earlier than timothy, and about the time of red clover, it makes an admirable mixture with that plant, to cut in the blossom and cure for hay. As a pasture grass it should be fed close, both to prevent its forming tufts and to prevent its running to seed, when it loses a large proportion of its nutri-

tive matter and becomes hard and wiry. All kinds of stock eat it greedily when green.

It is suited to all arable soils. Two bushels of seed are requisite for an acre when sown alone, or half this quantity when sown with clover. The seed is very light, weighing not more than twelve or fourteen pounds to the bushel. It should be cut early for hay.

Meadow spear grass, nerved manna grass (*Glyceria nervata*), is the fowl meadow of many farmers, while the grass commonly called fowl meadow by others (*Poa serotina*) often goes with them under the name of bastard fowl meadow. It has a broad, open panicle, often six inches in length, with slender branches; spikelets small, ovate, oblong, green; leaves in two rows like a fan, a little rough; stem a little compressed, one to three feet high. It is a native American grass, the nutritive value of which is equal at the time of flowering and when the seed is ripe, while the nutritive matter of the lattermath is said to be greater than that of most other grasses. It is a hardy grass, grows best on a moist ground, but it is said to succeed on lightish upland soils. It is a very valuable native grass, retaining its nutritive qualities until the seed is ripe, and then sending up large, fan-like shoots, which are succulent and nutritious. It would be a valuable ingredient in a mixture for wet or moist pastures.

Hungarian grass, Hungarian millet (*Panicum Germanicum*), is an annual forage plant, introduced into France in 1815, where its cultivation has become considerably extended. It germinates readily, withstands the drought remarkably, remaining green even when other vegetation is parched up, and if its development is arrested by dry weather, the least rain will restore it to vigor. It has numerous succulent leaves, which furnish an abundance of green fodder, very much relished by all kinds of stock.

It flourishes in somewhat light and dry soils, though it attains its greatest luxuriance in soils of medium constancy and well manured. It may be sown broadcast, and cultivated precisely like the varieties of millet.

Broom corn (*Sorghum saccharatum*) is considered by some botanists as a variety of *Sorghum vulgare*; by others, as a distinct species. Its leaves are linear; ligules short and hairy; panicle with long, loose, expanding branches. It is an annual, and flowers in August, growing from six to nine feet high. Native of India.

The panicles are used for brooms, and the seeds for poultry, swine, etc. It is extensively cultivated in many parts of the country along the Connecticut River, in Massachusetts, the Mohawk, in New York, and at the West. It is said to have been first cultivated in this country by Dr. Franklin, who found a seed on a stalk in the possession of a lady, and planted it.

Red clover (*Trifolium pratense*) is one of the most valuable and economical forage plants. It belongs to the pulse family, or *Leguminosæ*, which includes the larger portion of forage plants called artificial grasses, in distinction from the graminææ, the only true, and often called the natural grasses. The generic name, trefoil, or trifolium, is derived from the Latin *tres*, three, and *folium*, a leaf; and the genus can generally be very readily distinguished by the number and arrangement of its leaves in three leaflets, and flowers in dense oblong or globular heads.

The stems of the red clover are ascending, somewhat hairy; leaflets oval or obovate, often notched at the end, and marked on the upper side with a pale spot; heads ovate, and set directly upon the stalk,

instead of upon branches. This species is regarded as by far the most important of the whole genus for the practical purposes of agriculture. It has passed into a number of varieties, one of which is biennial, another perennial; the latter by long cultivation becoming biennial, while the former—as is true of most biennial, and many annual, plants—assumes, to some extent, the character of a perennial, and can be made to last three or four years, or even more, by simply preventing it from running to seed.

White clover is widely diffused over this country and all the countries of Europe. It is indigenous probably both to England and America. When first cultivated from seed collected from wild plants, at the beginning of the last century, it was recorded of a farmer that he had “sowed the wild white clover which holds the ground and decays not.” Its chief value is as a pasture grass, and it is as valuable for that purpose as the red clover is for hay or for soiling, though there are some who place a low estimate upon it.

It easily accommodates itself to a great variety of soils, but grows most luxuriantly in moist grounds and moist or wet seasons.

The yellow clover, hop trefoil or shamrock (*Trifolium procumbens*), like the white, is of spontaneous growth, very hardy and prolific. It bears a yellow flower and black seeds. It is one of those unostentatious plants which, though never sown and little heeded, help to make up that useful variety which gives value and permanence to our best pasture lands.

Alfalfa or lucern (*Medicago sativa*) is one of the most productive plants for forage ever cultivated. It was extensively cultivated by the Greeks, and other nations of antiquity, for many centuries, and it has been a prominent object of attention in Italy, Spain, France, Holland and Flanders. Its relative value, as compared with clover (*T. pratense*), is decidedly inferior, while its absolute value per acre is much greater. It was early introduced into this country. It bears from three to five crops per annum, containing from three to eight tons of hay. Those who have cultivated it pronounce it hardy and as capable of successful growth in this country as clover, but to reach the highest product it requires a richness of soil, and carefulness of cultivation which would give an enormous produce to its more humble rival. Our climate in the Northern and Middle States is too cold for it, but it grows luxuriantly in California. It must have a deep, dry, loamy soil. It may be lightly cropped the first year, and more freely the second, but it does not attain full maturity till the third. The roots strike deep into the ground, and being a perennial it requires no renewal, except from the loss of the plants by casualties. It should be cut before getting too heavy, and cured like clover. Liquid manure is good for it, as are also gypsum and ashes. Barnyard manure is necessary, but to avoid weeds it must be thoroughly fermented to destroy all the seeds. It is sometimes sown broadcast, but the rapid progress of weeds, grass, etc., in the soil will soon extirpate it if they are suffered to grow.

TEXTILES AND FIBROUS PLANTS.

Cotton, an important vegetable fiber, extensively cultivated in various parts of the globe within the 35th parallel of latitude.

Cotton is the produce of all the species of the genus *Gossypium* which belongs to the natural order Malvaceæ, and is thus allied to Mallow, Hollyhock, Hibiscus, etc., the general resemblance to which is very apparent both in the foliage and flowers. The

species are partly shrubs, partly herbaceous, and either perennial or annual; they are natives of the tropical parts of Asia, Africa, and America, but their cultivation has extended far into the temperate zones. They all have leaves with three to five lobes, which in a very young state are often sprinkled with black points, and rather large flowers, which are mostly yellow, but sometimes in whole or in part purple; the flowers very soon fall off; they grow singly from the axils of the leaves, and are surrounded at the base by three large, heart-shaped, cut or toothed, involucre leaves or bracts, partially growing together as one. The fruit is a 3-5-celled capsule, springing open when ripe by 3-5 valves, and containing numerous seeds enveloped in cotton, which is generally white, but sometimes yellow, and issues elastically from the capsule after it has burst open. The fibers are long cylindrico-spiral tubes of from $\frac{1}{16}$ th to $\frac{1}{8}$ th of an inch in breadth, which, when platted, adhere firmly together. The wool is also very susceptible of dyeing. Some of the kinds have the flowers larger in proportion, and the leaves divided into more numerous and much deeper and narrower lobes, but the general appearance of all is very similar.

Difference of opinion exists among botanists as to the number of distinct species, and there are very many varieties in cultivation, the number of which, through climatic influences and other causes, is continually increasing; but there are certain leading peculiarities on account of which some botanists and planters reduce all, at least of the cultivated kinds, to four primary species—viz. (1) *Gossypium barbadense*; (2) *G. herbaceum* or *indicum*; (3) *G. peruvianum*; and (4) *G. arboreum*. The produce of the first species is the most valuable. The beautiful long-stapled ($1\frac{1}{2}$ to $2\frac{1}{2}$ inches) silky wool known as “Sea Island” is a variety, and is grown exclusively upon the islands and a portion of the mainland of Georgia, South Carolina, and Florida, the saline ingredients of the soil and atmosphere being indispensable elements of the growth. The plant, 6 to 12 feet in height, bears a yellow flower, and the seeds are small, black, and quite smooth, and the wool is easily separated therefrom; but when sown far inland, away from the saline influences of the coast, the seeds increase in size, and become covered with innumerable short hairs. A large percentage of the crops raised in Alabama, Louisiana, Mississippi, Texas, etc., are almost varieties of this species, though, owing to climatic influences, the plant is smaller (4 to 6 feet in height), and the wool is shorter in staple ($\frac{3}{4}$ to $1\frac{1}{4}$ inch), and less easily separated from the seeds than Sea Island. *G. herbaceum* is found in India, China, Africa, etc. The principal commercial varieties are those known as Surat, Madras, Bengal, etc. It is a small shrubby plant (2 to 4 feet high), bears a yellow flower, the seeds are covered with short grayish down, and the staple produced, though not long ($\frac{3}{8}$ to 1 inch), is very fine. The cotton known as nankeen is thought to belong to this species. *G. herbaceum* can be more profitably cultivated in colder countries than any other species of cotton-plant. The third species (*G. peruvianum*) is a native of South America, and the “green seed” cotton of the United States appears to be a variety. The stem reaches 10 to 15 feet in height, the flowers are yellow, and the capsules contain eight or ten black seeds firmly attached together in a cone-like mass. The wool is long (1 to $1\frac{1}{2}$ inch) and strong-stapled, and in value stands next in order to Sea Island and Egyptian. *G. arboreum* is found in India, China, etc., and, as its name imports, is a large tree-like plant. It bears a red flower, and produces a fine

yellowish-white wool. Varieties of it have been long cultivated in the United States, and with the requisite soil and climate, are said to produce a wool somewhat resembling Sea Island.

The finer kinds of yarn are spun from Sea Island and long-stapled Egyptian, and from them are fabricated our muslins, laces, etc. From Brazil and the better classes of short-stapled American come our cambrics, calicoes, shirtings, sheetings, etc., and from the inferior qualities of American and Surat are spun the coarse yarns required for fustians and other heavy fabrics. Yorkshire broadcloths are sometimes half cotton. From warps of cotton, and wefts of wool or worsted, are formed varieties of Orleans cloths, Coburgs, mousselines de laine, etc. There are also fabrics composed of silk and cotton, linen and cotton, alpaca and cotton, etc.

The plant is a very delicate organism, and requires a peculiar soil and climate for its due development. The method of cultivation is much the same in the various countries where the fiber is grown; but the most perfect system is that which obtains in this country. Although the plant is not, strictly speaking, an annual, it is found more profitable to destroy the shrub after the crop is gathered, and sow new seed every year. The preparation of the land takes place during the winter months. After the ground has been thoroughly plowed, and as soon as all symptoms of frost have disappeared, the soil is laid off into rows varying in width from three to four feet, according to the situation and quality of the soil. The seed is then sown along the center of the beds in a straight furrow made with a small plow or opener; but in some plantations the seed is sown in holes from twelve to eighteen inches apart. The sowing commences in March, and generally continues through April; sometimes, owing to late spring frosts, the planting is prolonged to May. The young shoot appears above ground in about eight or ten days, and is then and subsequently weeded and thinned. Blooming takes place about the beginning of June—in early seasons toward the latter end of May; the average date is about June 5. For plowing, the planter requires just sufficient rain to give the soil a moist and spongy texture. During the early stages of its growth, the crop flourishes best with a warm steamy sort of weather, with an occasional shower until blooming, too much rain being productive of weeds and wood at the expense of wool, while a severe drought produces a stunted plant, forced into too early maturity, and resulting in a small and light-stapled crop. A great deal, however, depends upon the position of the plantation, lands situated in hilly or upland districts obviously requiring more moisture than those lying in the plains and river-bottoms. From the date of blooming to the close of the picking season, warm dry weather is essential. Picking generally commences in August, occasionally in July, and continues until the occurrence of frost—about the end of October or beginning of November—puts a stop to the further growth of the plant. Occasionally, in the absence of a killing frost, picking extends to December or January, and even into February, but the cotton is inferior in grade and quality. All the available hands of the plantation, young and old, are called into full employment during the harvest. The cotton is gathered into baskets or bags suspended from the shoulders of the pickers, and when the crop has been secured, it is spread out and dried, and then separated from the seeds.

The latter process was formerly performed by hand—a tedious operation, by which one hand could clean only

a pound or so a day; but since the invention of the saw-gin by Eli Whitney, in 1793, the process of cleaning has been both rapid and effectual. This machine is composed of a hopper, having one side formed of strong parallel wires placed so close together as to exclude the passage of the seeds from within. The wool is dragged through the apertures by means of circular saws attached to a large roller, and made to revolve between the wires, the seeds sinking to the bottom of the hopper. The process is adopted only in cleaning the short-stapled varieties of American cotton, the wool of which adheres so firmly to the seeds as to require a considerable amount of force to separate them. The Sea Island variety is cleaned by being passed through two small rollers which revolve in opposite directions, and easily throw off the hard, smooth seeds.

Hemp—(*Cannabis*), a genus of plants of the natural order Cannabinaceæ, having the male and female flowers on different plants; the male flowers with five-partite calyx and five stamens; the female flowers with a spathe-like calyx of one leaf, rolled round the ovary and partially split along one side, and two thread-like stigmas. There is only one known species *C. sativa*, varying considerably, however, from soil, climate, and cultivation. It is an annual plant, a native of the warmer parts of Asia, but has been cultivated in Europe from the earliest historic times, and is now naturalized in many parts of Europe and America. Like flax, it adapts itself wonderfully to diversities of climate, and is cultivated equally under the burning sun of the tropics and in the northern parts of Russia. It is, however, readily injured by frost, particularly when young; and in many countries where it is cultivated it succeeds only because the warmth of the summer, though of short duration, is sufficient for its whole life. Hemp varies very much in height, according to the soil and climate, being sometimes only three or four feet and sometimes fifteen or twenty feet, or even more. Notwithstanding the coarseness of its leaves, it is an elegant plant, and is sometimes sown on this account in shrubberies and large flower-borders. The stem is erect, more or less branched; the leaves are five to nine-fingered. The flowers are yellowish-green, small and numerous; the male flowers in axillary racemes on the upper parts of the plant; the female flowers in short axillary and rather crowded spikes. The female plants are higher and stronger than the male. The stem of hemp is hollow, or only filled with a soft pith. This pith is surrounded by a tender, brittle substance, consisting chiefly of cellular tissue, with some woody fiber, which is called the *reed, boon or shove* of hemp. Over this is the thin bark, composed chiefly of fibers extending in a parallel direction along the stalk, with an outer membrane or cuticle.

Hemp is cultivated for its fibers in almost all countries of Europe, and in many other temperate parts of the world, most extensively in Poland, and in the center and south of European Russia, which are the chief hemp-exporting countries. French hemp is much esteemed in the market, as is also that of England and Ireland, of which, however, the quantity is comparatively inconsiderable. *Bolognese hemp* and *Rhenish hemp* are varieties remarkable for their height; and a fiber of very fine quality, eight or nine feet long, is known in commerce by the name of *Italian garden hemp*. In this country most of the hemp is grown in Kentucky. In cultivating hemp it is very necessary to have the soil so rich, and to sow the seed at such a season, that the plants shall grow rapidly at first, as they thus

form long fibers. A crop of short scrubby hemp is almost worthless. The finer kinds of hemp are used for making cloth, the coarser for sailcloth and ropes. Hemp sown thin produces a coarser fiber than hemp sown thick. Something also depends on the time of pulling, for the crop is pulled by the hand. When a rather fine fiber is wanted, and the seed is not regarded, the whole crop is pulled at once, soon after flowering; otherwise, it is usual to pull the male plants as soon as they have shed their pollen, and to leave the female plants to ripen their seed, in which case the fiber of the female plants is much coarser. The treatment of hemp by *retting*, etc., is similar to that of flax. The fiber of hemp is generally used for coarser purposes than that of flax, particularly for sailcloth, pack-sheet, ropes, and the calking of ships.

The seed of hemp is produced in great abundance. It is commonly sold as food for cage-birds; and birds are so fond of it that not only the ripening fields, but the newly-sown fields, must be carefully guarded against their depredations. A fixed oil, *oil of hempseed*, is obtained from it by expression, which is at first greenish-yellow and afterwards yellow, and has an acrid odor, but a mild taste. This oil is used in Russia for burning in lamps, although the wick is apt to get clogged, also for making paints, varnish, and a kind of soft soap.

Hemp is cultivated in warm countries not so much for its fiber as for a resinous secretion, which has narcotic or intoxicating qualities. Hemp is also used as a therapeutic agent under the name of Indian Hemp, or Bhang, and may be administered in the form of resinous extract or of tincture; and it is usually prescribed (like opium) for its hypnotic, anodyne and anti-spasmodic properties.

Flax (Linum), the typical genus of Linaceæ a sub-order of Geraniaceæ, consisting of about 140 species of annual and perennial herbaceous plants, with a few small shrubs, all inhabitants of temperate climates, most abundant in Europe and northern Africa. Some are cultivated as showy garden annuals, *e. g. Linum grandiflorum*, etc., while the allied *Radiola millegrana* (Allseed) is the smallest of the phanerogamic weeds. *L. catharticum*, an annual weed, is the Purging Flax, long a standard resource of domestic medicine. But all essential interests center round the Common Lint or Flax, well named by Linnæus *L. usitatissimum*, since in its importance for civilized man it rivals the staple food plants. There are two main varieties of sub-species—*vulgare* and *crepitans*, the latter distinguished by its shorter and more branched stems and rather larger leaves, but more easily by its large capsules, which burst open, when ripe, with a characteristic sound, so scattering the seed. Though shorter, this yields the finer, softer, and whiter fiber. In both the flower is a loose corymb of beautiful blue flowers. *L. austriacum* is also cultivated in France, *L. maritimum* in southern Europe, and *L. lewisii* in North America, but all yield a coarser fiber. The flax of pre-historic times found in the Swiss pile-dwellings, and in the remains of the stone age in northern Italy, was derived from *L. angustifolium*, as not only the manufactured product but the actual remains of the stems, fruit and seeds clearly show. The common lint of the Aryan peoples was, however, *L. usitatissimum*, and the occurrence of the name lint, with little modification in all European languages, is usually interpreted as indicating that its use dates from the remote antiquity of their common home. The same culture is shown by an examination of the mummy-cloths of Egypt, which are always of linen; and the species is also recognizably delineated upon the walls of the tombs.

TUBERS AND ROOTS.

The varieties of the potato, whether for garden or field culture, are exceedingly numerous, and admit of endless increase by propagating from seeds. When the crop is grown for cattle food, bulk of produce will be the primary consideration; but for sale or family use, flavor, keeping quality, and handsome appearance will be particularly attended to. Exemption from disease is now a momentous consideration, whatever the use for which it is grown. There is difficulty, however, connected with selections on the score of healthiness, that while in each season since the disease broke out certain varieties have escaped, it is observed from year to year that the exempted list varies, certain kinds that had been previously healthy becoming as obnoxious to disease as any, and others in a great measure escaping that had suffered much before. Indeed, certain persons, from observing that diseased tubers left in the ground have produced healthy plants in the following season, have been induced purposely to plant diseased potatoes, and with good results. This, however, is due to the mere fact of their being kept in the earth.

In corn culture the potato is frequently grown on a portion of the fallow break; but its appropriate place in the rotation is that usually assigned to beans, with which, in an agricultural point of view, it has many things in common, and in lieu of which it may with advantage be cultivated. As a potato requires to be planted as early in spring as the weather will admit of, thus leaving little opportunity for cleaning the land, and as its mode of growth forbids any effective removal of root-weeds by after culture, it is peculiarly necessary to have the land devoted to this crop cleaned in autumn. Winter dunging facilitates the planting, and is otherwise beneficial to the crop by producing that loose and mellow condition of the soil in which the potato delights. The quality of the crop is also believed to be better when the dung is thoroughly incorporated with the soil, than when it is applied in the drill at the time of planting. A liberal application of manure is necessary if a full crop is expected. The rank growth thus induced renders it, however, more obnoxious to the blight, and hence at present it is more prudent to aim rather at a sound crop than an abundant one, and for this purpose to stint the manure. When it is applied at the time of planting, the mode of procedure is the same as that which will presently be described in the section on turnip culture. The potato sets are prepared a few days before they are expected to be needed. Tubers about the size of an egg do well to be planted whole; and it is a good plan to select these when harvesting the crop, and to store them by themselves, that they may be ready for use without further labor. The larger tubers are cut into pieces, having at least one sound eye in each, although two are better. It is of great consequence to have seed potatoes stored in a cool and dry pit, so that if possible they may be prepared for planting before they have begun to shoot. If there has been any heating in the pit, the potatoes are found to be covered by a rank crop of shoots, which are necessarily rubbed off, and thus the most vigorous eyes are lost, and much of the substance which should have nourished the young plant is utterly wasted. A sufficient number of dormant eyes are no doubt left, but from the comparatively exhausted state of tubers, these produce stems of a weaker and more watery character, and more liable to disease than those first protruded.

Potato drills should not be less than thirty inches wide, nor the sets less than ten to twelve inches apart in the rows. The usual practice is to take the sets to

the field in sacks, which are set down at convenient distances for replenishing the baskets or aprons of the planters. When a large breadth is to be planted, a better way is to have the sets in carts, one of which is moved slowly along in front of the planters. A person is seated in the cart, who has by him several spare baskets which he keeps ready filled, and which are handed to the planters in exchange for empty ones as often as required.

When the crop is matured, which is known by the decay of the tops and the firmness of the epidermis when the tubers are forcibly rubbed by the thumb, advantage is taken of every dry day in harvesting the crop. With small plots, the fork is certainly the most efficient implement for raising the tubers; but on the large scale, when expedition is of great consequence, they are always unearthed by the double mold-board plow. Alternate rows are split open in the first instance, and then the intervening ones, as the produce of the first is gathered. When a convenient breadth has been cleared a turn of the harrow is given to uncover such tubers as have been hid from the gleaners at the first going over. The work is now very generally accomplished by means of a bulking-trough divested of its wings, and having attached to its sole a piece of iron terminating in radiating prongs. This being worked directly under the row of potato plants, unearths the tubers, and spreads them on the surface by one operation. The potatoes are gathered into baskets, from which they are emptied into carts and conveyed at once to some dry piece of ground, where they are piled up in long narrow heaps and immediately thatched with straw. The base of the heaps should not exceed a yard in width, and should be raised above the surface level rather than sunk below it as is very usually done. As the dangers to be guarded against are *heating* and *frost*, measures must be taken with an eye to both. The crop being put together in as dry and clean a state as possible, a good covering of straw is put on, and coated over two or three inches with earth, care being taken to leave a chimney every two yards along the ridge. By thus keeping the heaps dry and secure from frost, it is usually possible, even yet, to preserve potatoes in good condition till spring. Such diseased ones as have been picked out at the gathering of the crop can be used for feeding cattle or pigs.

Turnips.—The introduction of turnips as a field crop constitutes one of the most marked epochs in English agriculture. To the present day no better criterion exists in that country by which to estimate its state in any district, or the skill of individual farmers, than the measure of success with which this or other root crops are cultivated.

In the United States the turnip has by no means attained this dignity. It is usually a kitchen-garden or "patch" crop, valued mostly as a vegetable for rural table use. There are many varieties grown, the cultivation of which is well understood. Considered in its connection with other root crops, the turnip is one of the means by which the British agriculturist is misled in his estimates of the state of American agriculture. There is no sign at present that root-crops are destined in this country to take the place they hold in old-world agriculture.

Mangel-Wurzel.—This root has been steadily rising in estimation of late years. It is peculiarly adapted for those parts where the climate is too hot and dry for the successful cultivation of the turnip. A competent authority declares that it is there easier to obtain thirty tons of mangold than twenty tons of swedes, and that it is not at all unusual to find individual roots upward

of twenty pounds in weight. In Scotland it is just the reverse, it being comparatively easy to grow a good crop of swedes, but very difficult to obtain twenty tons of mangold. This plant is very susceptible of injury from frost, and hence in the short summers of the north it can neither be sown so early nor left in the ground so late as would be requisite for its mature growth. These difficulties may possibly be got over either by the selection of hardier varieties or by more skillful cultivation. Its feeding quality is said to be nearly equal to that of the swede; it is much relished by live stock—pigs especially doing remarkably well upon it; and it has the very important property of keeping in good condition till midsummer if required. Indeed, it is only after it has been some months in the store heap that it becomes a palatable and safe food for cattle. It is, moreover, exempt from the attacks of the turnip beetle.

Carrot.—This root, though so deservedly esteemed and universally grown in gardens, has not hitherto attained to general cultivation as a field crop. This is owing chiefly to certain practical difficulties attending its culture on a larger scale. Its light, feathery seeds cannot easily be sown so as to secure their regular germination; the tardy growth of the young plants, and the difficulty of discriminating between them and weeds makes the thinning a troublesome affair; the harvesting of the crop is comparatively expensive; and it is only on sandy and light loamy soils, or those of a peaty character, that it can be grown successfully. The increasing precariousness in the growth of potatoes, turnips and clover, and the consequent necessity for a greater variety of green crops, entitle the carrot to increased attention as a field crop. Its intrinsic qualities are, however, very valuable, especially since the introduction of the white Belgian variety. On light soils it is alleged that larger crops of carrots can be obtained than of turnips, and with less exhaustion of their fertility, which is explained as arising from the greater depth to which the carrots descend for their nourishment. This root is eaten with avidity by all kinds of farm stock. Horses, in particular, are very fond of it, and can be kept in working condition with a considerably smaller ration of oats when twenty pounds of carrots are given them daily.

Parsnip.—This plant bears so close a resemblance to the carrot, and its culture and uses are so similar, that they need not be repeated. It can, however, be cultivated successfully over a much wider range of soils than the carrot, and, unlike it, rather prefers those in which clay predominates. The cows fed on parsnips and hay yield butter little inferior, either in color or flavor, to that produced from pasture. About ten pounds of seed are required per acre. It requires, like that of the carrot, to be steeped before sowing, to hasten germination, and the same care is needed to have it fresh and genuine. It should be sown in April. The roots, when matured, are stored like carrots.

Oil-Yielding Plants.—Various plants are occasionally cultivated for the sake of the oil which is expressed from their ripened seeds. We have already noticed the value of flax-seed for this purpose, although the fiber is the product which is chiefly had in view in cultivating it. The plants most commonly sown expressly as oil-yielding crops are—rape (*Brassica Napus*), colza (*Brassica Campestris oleifera*), gold of pleasure (*Camelina sativa*), and the poppy (*Papaver somniferum*). Rape is the plant most frequently and extensively grown for the production of oil. The colza is said to yield better crops of seed than the other species. It is chiefly on rich alluvial soils that the crop is grown. For a seed-crop rape is sown in June or July, precisely

in the manner already described for turnips. The young plants are thinned out to a width of six to eight inches apart, and afterward kept clean by hoeing. The foliage may be eaten down by sheep early in autumn without injuring it for the production of a crop of seed. In spring the horse and hand hoe must be used, and the previous application of one or two hundredweight of guano will add to the productiveness of the crop. It suits well to lay down land to clover or grass after a crop of rape or turnip seed, and for this purpose the seeds are sown at the time of giving this spring culture. The crop must be reaped as soon as the seeds are observed to acquire a light brown color. The reaping is managed precisely as we have described in the case of beans. As the crop, after being reaped and deposited in separate handfuls on the floor, very soon gets dry enough for threshing, and as the seed is very easily shed after this is the case, this process must be performed as rapidly as possible. Of late years in the United States cotton seed has become one of the most fruitful sources of oil. The product, when carefully prepared and rectified, is fully the equal of the best olive oil for any of the purposes for which the latter is used. Its cheapness recommends it, in its various forms of preparation, for the housekeeper's use, while the residuum, or oil cake, is one of the best of foods for fattening cattle.

Seeds of Agricultural Crops.—In the case of seed-corn it is customary for farmers either to select from the best of their own growth, to exchange with or purchase from neighbors, or if they wish a change from a different locality, to employ a commission agent to buy for them. In all districts there are careful farmers who, by occupying land that produces grain of good appearance, and being at pains to have good and pure sorts, are stated shellers of seed-corn. It is therefore only in the case of new and rare varieties that professional seedsmen ordinarily deal in seed-corn. There are, however, other field crops, such as clovers, grasses, turnip, mangold, carrots, winter vetches, etc., the seeds of which to a large extent, pass through the hands of seedmen, and the growing of which is restricted to particular districts, and is in the hands of a limited number of farmers.

Clover is grown for the sake of its seeds. When it is meant to take a crop of seed, the clover is fed off with sheep, or mown early in the season, and then allowed to produce its flowers and ripen its seeds. This preliminary eating or cutting over causes the plants to throw up a greater number of seed-stems, and to yield a fuller and more equally ripening crop. The crop is mown when the seeds are seen to be matured. In the case of white clover the cutting takes place while the dew is upon the crop, as working among it when dry would cause a loss of seed. After mowing and turning the crop, the ground is raked with close-toothed iron rakes, to catch up loose heads. The threshing is a two-fold process—first the separation of the heads or cobs from the stem, called “cobbing” and then of the seeds from the husks, called “drawing.”

Turnip seed is the next most important crop of this kind. From the strong tendency in the best varieties of turnips and swedes to degenerate, and the readiness with which they hybridize with each other, or with any member of the family *Brassica*, no small skill and pains are needed to raise seed that can be depended upon to yield roots of the best quality. Turnip seed is saved either from selected or transplanted roots, or from such as have been sown for the express purpose, and allowed to stand as they grow.

In addition to what we have said under the heads of “wheat” and “corn,” on the subject of agricultural machinery, we have this to add, with a special reference to the tools used in the breaking of the soil. Of these the first place is unquestionably due to the plow. A history of this implement, tracing its gradual progress from the ancient *Sarcle* to its most improved form of the present day, is necessarily a history of agriculture. So much is this the case, that a tolerably correct estimate of the progress of the art in any country, whether in ancient or modern times, may be formed by ascertaining the structure of the plow. Much attention has been paid to its construction for the last hundred years, and never more than at the present day. After all that has been done, it is still, however, an unsettled point, which is the best plow for different soils and kinds of work; and accordingly many varying forms of it are in use. Those who know the difficulty of getting a field plowed uniformly and especially of getting the depth of furrow specified by the farmer adhered to over a field, and by all the plowmen, can best appreciate the value of an implement that, when once properly adjusted, will cut every furrow of an equal width and depth, and lay them all over at exactly the same angle.

Plows which break and stir the subsoil, without bringing it to the surface, by following in the wake of the common plow, are now much used. Since the introduction of thorough drainage, it is found beneficial to loosen the soil to a much greater depth than was formerly practicable, and this class of implements is well fitted for the work. It is always advisable to use this implement, and to mark and dig out the large stones encountered by it, before introducing steam cultivation.

Next in importance to the plow is the class of implements variously called grubbers, cultivators, drags or scarifiers. To prepare the soil for the crops of the husbandman, it is necessary to pulverize it to a sufficient depth, and to rid it of weeds. The appropriate function of the plow is to penetrate, break up, and reverse the firm surface of the field. This, however, is only the first step in the process, and does but prepare for the more thorough disintegration which has usually been accomplished by harrowing, rolling, and repeated plowings. Now, however excellent in its own place, the plow is a cumbrous and tedious pulverizer, besides needlessly exposing a fresh surface at each operation, and cutting the weeds into minute portions, which renders their removal more difficult. These defects were long felt, and suggested the desirableness of having some implement of intermediate character betwixt the plow and the harrow, which should stir the soil deeply and expeditiously without reversing it, and bring the weeds unbroken to the surface.

When a field has been broken up by the plow, it is usually next operated upon by the harrow, whether the object be to prepare it for and to cover in seeds, or to bring clods and roots to the surface. This is virtually a rake dragged by horses. In its most ordinary form, the framework is of wood with iron tines, of which each harrow contains twenty. Formerly each horse dragged a single harrow, although two or more were worked abreast. Under this arrangement the harrows had too much independent motion, and were liable to get foul of each other. This has been remedied, first, partially by coupling them loosely by riders, and then more effectually by a hinge-like join-

ing, which allows a separate vertical motion, but only a combined horizontal one. A rhomboidal form is also given to this *pair* of harrows—usually called *brakes*—so that when properly yoked, no two times run in the same track. This description of harrow is now frequently made entirely of iron.

Although many attempts have been made to adapt the locomotive steam engine for the conveyance both of passengers and goods on common roads, the results hitherto have not been altogether satisfactory. Progress is, however, undoubtedly being made in this effort; and, in not a few instances, such engines are actually in use for the carriage of heavy goods.

The extent to which steam power is now employed for the purposes of the farm is another marked feature in the recent progress of agriculture. It has been satisfactorily shown that grain can be threshed and dressed by well-constructed, steam-propelled machinery, at one-fourth the cost of threshing by horse power, and dressing by hand-fanners. So great, indeed, is the improvement in steam engines, and so readily can the amount of power be accommodated to the work to be done, that we find them everywhere superseding the one-horse gin, and even manual labor, for pumping, churning, coffee-grinding, etc. Wherever, then, a threshing machine is used at all, it may be safely asserted that, next to water, steam is the cheapest power by which it can be propelled. The *portable* engine is the form which has hitherto found most favor.

The portable engine with tubular boiler is that exclusively used in the United States for agricultural uses. The stationary engine may be said to be practically unknown. Threshing, an enormous piece of work in the aggregate when the enormous product is considered, is now universally done by engines purposely constructed, mounted upon wheels, easily conveyed from place to place, and often so constructed as to draw the thresher after them on the common roads.

In connection with this may be mentioned the threshing machine itself. This began some fifty years ago in a machine which was pegged down to the ground, and driven by a "horse-power," consisting of gears, and long sweeps to which the horses were attached. This machine was known as a "ground-hog thresher," and had no arrangements for winnowing the grain, for sifting it, for fanning away the chaff, for stacking the straw, etc. The next step was the mounting of the thresher on wheels permanently, still driving it with horse power in the old way. Then came the now familiar huge red box on wheels, furnished not only with the spiked cylinder and concave for actually threshing out the grain, but with winnowing and screening devices, a straw-carrier, a measuring-device, etc. Lastly the engine, mounted, was made to accompany the same, and this, with various modifications, is the machine now almost universally used.

The now frequent use of various kinds of grain in the fattening of live stock creates a necessity for machines to prepare it for this purpose, either by breaking, bruising, or grinding. A profusion of these, to be worked by hand, is everywhere to be met with. Such machines are most usually worked by horse power, and are very simple and inexpensive.

The use of chaff-cutters has increased very much of late years. Fodder, when cut into lengths of from half an inch to an inch, is somewhat more easily masticated than when given to animals in its natural state, but the chief advantages of this practice are that it prevents waste, and admits of different quali-

ties—as of hay and straw, straw and green forage, or chaff and pulp roots—being so mixed that animals cannot pick out the one from the other, but must eat the mixture as it is presented to them. Such cut fodder also forms an excellent vehicle in which to give meal or bruised grain, either cooked or raw, to live stock. This applies particularly to sheep feeding on turnips, as they then require a portion of dry food, but waste it grievously when it is not thus prepared.

Cattle and sheep which have arrived at maturity are able to scoop turnips rapidly with their sharp, gouge-like front teeth, and so can be fattened on this kind of food without an absolute necessity of slicing it for them. Even for adult animals there is, however, an advantage in reducing turnips to pieces which they can easily take into their mouths, and at once get between their grinders without any preliminary scooping; but for young stock, during the period of dentition, it is indispensable to their bare subsistence. It is largely through the use of slicing-machines that certain breeds of sheep are fattened on turnips and got ready for the butcher at fourteen months old.

In cattle feeding it is not usually thought necessary to divide the roots given to them so minutely as for sheep. A simple machine, fashioned much on the principle of nut-crackers, by which at each depression of the lever handle, one turnip is forced through a set of knives which divide it into slices each an inch thick, is very generally used for this purpose. Many persons, however, prefer to have the turnips put into the cattle-troughs whole, and then to have them cut by a simple cross-bladed hand-chopper, which at each blow quarters the piece struck by it. The mode of housing fattening cattle largely determines whether roots can be most conveniently sliced before or after being put into the feeding-troughs.

An opinion now obtains, and is on the increase, that it is advantageous to rasp roots into minute fragments and mix them with chaff before giving them to cattle, as this not only facilitates mastication, but in wintry weather prevents the chilly effects of a bellyful of such watery food as turnips are when eaten alone. This system is peculiarly appropriate, when it is desired to give a few roots to store cattle which are being fed mainly upon straw or coarse hay. When a few turnips or mangolds are put down in their natural state there is a scramble for the better food, in which the stronger cattle get more than their share, and the weaker are knocked about. But by pulping the roots and mixing them with a full allowance of chaff, every animal gets its fill, and there is nothing to quarrel about.

In the United States, of late years, the preservation of green food by packing in subterranean pits, under heavy pressure, has claimed a great deal of attention, and provoked a great deal of discussion as to relative merits and demerits. It will be treated at length under the heads of ENSILAGE and SILO.

We have several times alluded to the cooking of food for cattle. This is performed either by boiling in a common pot, by steaming in a close vessel, or by infusion in boiling water. Varieties of apparatus are in use for these purposes. A convenient one is a close boiler, with a cistern over it, from which it supplies itself with cold water by a self-acting stop-cock. This is alike suitable for cooking either by steaming or infusing.

DRAINAGE.

Before those simple tillage operations, which are necessary in every instance of committing seeds to the earth, can be gone about, there are more costly

and elaborate processes of preparation which must be encountered in certain circumstances, in order to fit the soil for bearing cultivated crops. It is now only in exceptional cases that the British agriculturist has to reclaim land from a state of nature. The low-country farmer does occasionally meet with a patch of woodland, or a bank covered with gorse or brushwood, which he sets about converting into arable land. In breaking up land that has been for a course of years under pasturage, paring and burning are also frequently resorted to in all parts of the country. The grand improvement of all, thorough underground drainage, is common to every district and class of soils.

To drain land is to rid it of its superfluous moisture. The rivers of a country with their tributary brooks and rills are the natural provisions for removing the rainwater which either flows directly from its surface, or which, after percolating through porous strata to an indefinite depth, is again discharged at the surface by springs. The latter may thus be regarded as the outlets of a natural underground drainage. This provision for disposing of the water that falls from the clouds is usually so irregular in its distribution, and so imperfect in its operation, that it leaves much to be accomplished by human labor and ingenuity. The art of the drainer accordingly consists—

1st. In improving the natural outfalls by deepening, straightening, or embanking rivers; and by supplementing these, when necessary, by artificial canals and ditches; and,

2d. In freeing the soil and subsoil from stagnant water, by means of artificial underground channels.

The first of these operations, called *trunk drainage*, is the most needful; for until it be accomplished there are extensive tracts of land, and that usually of the most valuable kind, to which the secondary process either cannot be applied at all, or only with the most partial and inefficient results. Much controversy has taken place as to what this minimum depth is. Suffice it to say, that opinion is now decidedly in favor of a greater depth than was considered necessary even a few years ago, and that the best authorities concur in stating it at from three to four feet. There are persons who doubt whether the roots of our ordinary grain or green crops ever penetrate to such a depth as has now been specified. A careful examination will satisfy anyone who makes it, that minute filamentary rootlets are sent down to extraordinary depths, wherever they are not arrested by stagnant water. It has also been questioned whether any benefit accrues to crops from this deep descent of their roots. Some persons have even asserted that it is only when they do not find food near at hand that they thus wander. But it must be borne in mind that plants obtain moisture as well as nourishment by means of their roots, and the fact is well known that plants growing in a deep soil resting on a porous subsoil seldom or never suffer from drought. It is instructive, too, on this point, to observe the practice of the most skillful gardeners, and see the importance which they attach to trenching, the great depth at which they often deposit manure, and the stress which they lay upon thorough drainage. On the other hand, it is well known that soils which soonest become saturated, and run from the surface in wet weather, are precisely those which parch and get chapped the soonest in drought. The effectual way to secure our crops at once from drowning and parching, is to put the land in a right condition with respect to drainage.

All soils possess more or less the power of absorbing and retaining water. Pure clays have it in the

greatest degree, and gritty siliceous ones in the smallest. In dry weather this power of attracting moisture is constantly operating to supply from below the loss taking place by evaporation at the surface. In heavy rains, as soon as the entire mass has drunk its fill, the excess begins to flow off below; and therefore a deep stratum, through which water can percolate, but in which it can never stagnate—that is, never exceed the point of saturation—is precisely that in which plants are most secure from the extremes of drought and drowning.

If a perfect condition of the soil with respect to drainage is of importance for its influence in preserving it in a right condition as respects moisture, it is still more so for its effects upon its *temperature*. All who are conversant with rural affairs are familiar with that popular classification of soils in virtue of which such as are naturally dry are also invariably spoken of as *warm and early*; and conversely, that wet soils are invariably described as being *cold and late*. This classification is strictly accurate, and the explanation of it is simple. An excess of water in soil keeps down its temperature in various ways. In passing into the state of vapor it rapidly carries off the heat which the soil has obtained from the sun's rays. Water possesses also a high radiating power; so that, when present in the soil in excess, and in a stagnant state, it is constantly carrying off heat by evaporation and radiation. On the other hand, stagnant water conveys no heat downwards; for although the surface is warmed, the portion of water thus heated being lightest, remains floating on the surface, and will give back its heat to the atmosphere, but conveys none downwards.

But while the presence of stagnant water in a soil has this injurious power of lowering its temperature, a very different effect ensues when rainwater can sink freely into it to a depth of several feet, and then find a ready exit by drainage; for in this case the rainwater carries down with it the heat which it has acquired from the atmosphere and from the sun-heated surface, and imparts it to the subsoil. There is as yet a lack of published experiments to show the ordinary increase of temperature at various depths and in different soils, as the result of draining wet land. The temperature and other conditions of the atmosphere, which we call climate, are placed beyond human control; but this power of raising the temperature of all wet, and consequently cold soils, becomes tantamount in some of its results to a power of improving the climate. There are, accordingly, good grounds for stating that in numerous cases grain crops have ripened sooner by ten or twelve days than they would have done but for the draining of the land on which they grew.

The points which we have thus briefly touched upon are so essential to an intelligent appreciation of the subject, that we have felt constrained to notice them, however meagerly. But our space forbids more than a mere enumeration of some of the many evils inseparable from the presence of stagnant water in the soil, and of the benefits that flow from its removal. Wet land, if in grass, produces only the coarser grasses, and many sub-aquatic plants and mosses, which are of little or no value for pasturage; its herbage is late of coming in spring, and fails early in autumn; the animals grazed upon it are unduly liable to disease, and sheep, especially, to the fatal rot. When land is used as arable, tillage operations are easily interrupted by rain, and the period always much limited in which they can be prosecuted at all; the compactness and toughness of such land renders each opera-

tion more arduous, and more of them necessary, than in the case of dry land. The surface must necessarily be thrown into ridges, and the furrows and short-cuts duly cleared out after each process of tillage, on which surface expedients as much labor has probably been expended in each thirty years as would now suffice to make drains enough to lay it permanently dry. With all these precautions the best seed-time is often missed, and this usually proves the prelude to a scanty crop, or to a late and disastrous harvest.

The beneficial effects of thorough draining are of a very decisive and striking kind. The removal of stagnant water from a stratum of four feet in depth, and the establishing of a free passage for rainwater and air from the surface to the level of the drains, speedily effect most important changes in the condition of the soil and subsoil. Plowing and other tillage operations are performed more easily than before in consequence of a more friable state of the soil. Moderate rains which formerly would have sufficed to arrest these operations do so no longer, and heavy falls of rain cause a much shorter interruption of these labors than they did when the land was in its natural state. Deep tillage, whether by the common or subsoil plow (which formerly did harm), now aids the drainage, and is every way beneficial. Ridges and surface furrows being no longer needed the land can be kept flat, with great benefit to crops and furtherance to field operations. An earlier seed-time and harvest, better crops, a healthier live stock, and an improved style of husbandry, are the usual and well known sequents of judiciously conducted drainage operations.

Although it has been reserved to the present times to see land draining reduced to a system based on scientific principles, or very great improvement effected in its details, it is by no means a modern discovery. The Romans were careful to keep their arable lands dry by means of open trenches, and there are even some grounds for surmising that they used covered drains for the same purpose. Indubitable proof exists that they constructed underground channels by means of tubes of burned earthenware; but it seems more probable that these were designed to carry water to their dwellings, etc., than that they were used simply as drains.

In setting about the draining of a field, or farm, or estate, the first point is to secure, at whatever cost, a proper outfall. The lines of the receiving drains must next be determined, and then the direction of the parallel drains. The former must occupy the lowest part of the natural hollows, and the latter must run in the line of the greatest ascent of the ground. In the case of flat land, where a fall is obtained chiefly by increasing the depth of the drains at their lower ends, these lines may be disposed in any direction that is found convenient; but in undulating ground a single field may require several distinct sets of drains lying at different angles, so as to suit its several slopes. When a field is ridged in the line of the greatest ascent of the ground, there is an obvious convenience in adopting the furrows as the site of the drains; but wherever this is not the case the drains must be laid off to suit the contour of the ground, irrespective of the furrows altogether. When parts of a field are flat, and other parts have a considerable acclivity, it is expedient to cut a receiving drain near to the bottom of the slopes, and to give the flat ground an independent set of drains. In laying off receiving drains it is essential to give hedge-rows and trees a good offing, lest the conduit should be obstructed by roots. When a drain must of necessity pass near to

trees, we have found it practicable to exclude their roots from it by the use of coal-tar. In our own practice, a drain carried through the corner of a plantation has by this expedient remained free from obstruction for now fourteen years. In this instance the tar was applied in the following manner:—Sawdust and coal-tar being mixed together to the consistency of ordinary mortar, a layer of this was laid in the bottom of the trench; the drain-pipes were then laid, and completely coated over with the same mixture to the thickness of an inch, and the earth carefully replaced in the ordinary way. When a main drain is so placed that parallel ones empty into it from both sides, care should be taken that the inlets of the latter are not made exactly opposite to each other. Indeed, we have found it expedient in such cases to have two receiving drains parallel to each other, each to receive the subordinate drains from its own side only.

The depths of the parallel drains must next be determined. In order to obtain proper data for doing so, the subsoil must be carefully examined by digging test-holes in various places, and also by taking advantage of any quarries, deep ditches, or other cuttings in the proximity, that afford a good section of the ground. We have already expressed an opinion that the drains should not be less than four feet deep; but it is quite possible that the discovery at a greater depth than four feet of a seam of gravel, or other very porous material charged with water, underlying considerable portions of the ground, may render it expedient to carry the drains so deep as to reach this seam. Such a seam, when furnished with sufficient outlets, supplies a natural drain to the whole area under which it extends. When such exceptional cases are met with, they are precisely those in which deep drains, at wide intervals, can be trusted to dry the whole area. When the subsoil consists of a tenacious clay of considerable depth, it is considered by many persons that a greater depth than three feet is unnecessary. The greater depth is, however, always to be preferred; for a drain of four feet, if it works at all, not only does all that a shallower one can do, but frees from stagnant water a body of subsoil on which the other has no effect at all. It has indeed been alleged that such deep drains may get so closed over by the clay that water will stand above them. If the surface of clay soil is wrought into puddle by improper usage, water can undoubtedly be made to stand for a time over the shallowest drains as easily as over the deepest. But the contraction which always takes place in summer in good alluvial clays gradually establishes fissures, by which water reaches the drains. In such soils it is usually a few years before the full effect of draining is attained. The tardy percolation of water through clay soils seems also a reason why in such cases it should get the benefit of a greater fall, by making the drain deep.

Draining is always a costly operation, and it is therefore peculiarly needful to have it executed in such a way that it shall be effectual and permanent. We advocate a minimum depth of four feet, because of our strong conviction that such drains carefully made will be found to have both these qualities. And this opinion is the result of dear-bought experience, for we have found it necessary in our own case to reopen a very considerable extent of 30-inch drains in consequence of their having totally failed to lay the land dry, and to replace them by four-foot ones, which have proved perfectly efficacious. In doing this we have seen a 30-inch drain opened up and found to be perfectly dry, and yet when the same trench was deepened to four feet there was quite a run of water from

it. Now, also, that steam power has become available, for the tillage of the soil, and is certain, at no distant day, to be in general requisition for that purpose, it is peculiarly expedient to have the drains laid at such a depth as to admit of that potent agent being used for loosening the subsoil to depths hitherto unattainable, not only without hazard to the drains, but with the certainty of greatly augmenting their efficiency. The distance apart at which the drains should be cut must be determined by the nature of the subsoil. In the most retentive clays it need not be less than 18 feet. On the other hand, this distance cannot safely be exceeded in the case of any subsoil in which the clay predominates, although it should not be of the most retentive kind. In all parts of the country instances abound in which drains cut in such subsoils, from 24 to 30 feet apart, have totally failed to lay the land dry. When ground is once pre-occupied by drains too far apart, there is no remedy but to form a supplementary one betwixt each pair of the first set; and thus, by exceeding the proper width at first, the space betwixt the drains is unavoidably reduced to 12 or 15 feet, although 18 feet would originally have sufficed. It is only with a decided porosity in the subsoil, and in proportion to the degree of that porosity, that the space between drains can safely be increased to 24 or 30, or 36 feet.

Cylindrical pipes with collars are undoubtedly the best draining material that has yet been discovered. The collars referred to are simply short pieces of pipe, just so wide in the bore as to admit of the smaller pipes which form the drain passing freely through them. In use one of these collars is so placed as to encase the ends of each contiguous pair of tubes, and thus forms a loose fillet around each joining. The ends of these pipes being by this means securely kept in contact, a continuous canal for the free passage of water is infallibly insured, the joinings are guarded against the entrance of mud or vermin, and yet sufficient space is left for the admission of water. Pipes of all diameters, from 1 inch to 16 inches, are now to be had; those from 1 to 2 inches in the bore are used for subordinate drains; the larger sizes for sub-main and main receiving drains.

If a quicksand is encountered in constructing a drain, it will be found expedient to put a layer of straw in the bottom of the trench, and then, instead of the ordinary pipe and collar, to use at such a place a double set of pipes—one within the other—taking care that the joinings of the inner set are covered by the centers of the outer ones. By such precautions the water gets vent, and the running sand is excluded from the drain. When a brook has been diverted from its natural course for mill power or irrigating purposes, it often happens that portions of land are thereby deprived of the outfall required to admit of their being drained to a proper depth. In such cases it is frequently practicable to obtain the needed outlet by carrying a main drain through below the water-course, by using at that point a few yards of cast-iron pipe, and carefully filling up the trench with clay puddle, so that there may be no leakage from the water-course into the drain. While this is being done the water must either be turned off or carried over the temporary gap in a wooden trough.

Various attempts have from time to time been made to lower the cost of draining land by the direct application of animal or steam power to the work of excavation. A six-horse portable steam engine is anchored in one corner of the field to be drained. It gives motion to two drums, to each of which a rope 500 yards long is attached, the one uncoiling as the other

is wound up. These ropes pass round blocks which are anchored at each end of the intended line of drain, and are attached one to the front and the other to the hinder end of the draining apparatus. This consists of a framework, in which is fixed, at any required depth not exceeding $3\frac{1}{2}$ feet, a strong coultter terminating in a short horizontal bar of cylindrical iron, with a piece of rope attached to it, on which a convenient number of drain pipes are strung. This frame being pulled along by the engine, the coultter is forced through the soil at a regulated depth, and deposits its string of pipes with unerring accuracy, thus forming, as it proceeds, a perfect drain. The supply of pipes is kept up by means of holes previously dug in the line of the drain, at distances corresponding to the length of the rope on which they are strung.

New reclaimed lands, and even those that have long been under tillage, are frequently much encumbered with earthfast stones. Their removal is always desirable, though necessarily accompanied with much trouble and expense. In our personal practice we have proceeded in this way. In giving the autumn furrow preparatory to a fallow crop, each plowman carries with him a few branches of fir or beech, one of which he sticks in above each stone encountered by his plow. If the stones are numerous, particularly at certain places, two laborers provided with a pick, a spade, and a long wooden lever shod with iron, attend upon the plows, and remove as many of the stones as they can, while yet partially uncovered by the recent furrow. Those thus dug up are rolled aside upon the plowed land. When the land gets dry enough in spring, those not got out at the time of plowing are discovered by means of the twigs, and are then dug up. Such as can be lifted by one man are carted off as they are, but those of the larger class must first be reduced by a sledge hammer. They yield to the hammer more easily after a few days' exposure to drought than when attacked as soon as dug up. Before attempting to break very large boulders a brisk fire of dried gorse or brushwood is kept up over them until they are heated, after which a few smart blows from the hammer shiver them completely. Portions of otherwise good land are sometimes so full of these boulders, that to render it available, the stones must be got rid of by trenching the whole to a considerable depth. When plowing by steam power becomes general, a preliminary trenching of this kind will in many cases be requisite before tillage instruments thus propelled can be used with safety.

When the natural greensward, or ground that has been cleared of a cultivated crop, is to be prepared for the sowing or planting of further crops, the plow leads the way in breaking up the compact surface, by cutting from it successive slices, averaging about ten inches in breadth, by seven in depth, which it turns over upon each other to the right-hand side. This turning of the slices or furrows to one side only renders it necessary to square off the space to be plowed into parallelograms, half the slices of which are laid the one way, and the other half the other, by the going and returning of the plow. These parallel spaces are variously termed *ridges*, *stretches*, *lands* or *feirings*, which in practice vary in width from a few furrows to 30 yards. When very narrow spaces are used, a waste of labor ensues, from the necessity of opening out and then reclosing an extra number of index or guiding furrows; while very wide ones involve a similar waste from the distance which the plow must go empty in traversing at the ends. The spaces thus formed by equal numbers of furrow-slices

turned from opposite sides have necessarily a rounded outline, and are separated by open channels. In a moist climate and impervious soil, this ridging of the surface causes rainwater to pass off more rapidly, and keeps the soil drier than would be the case if it was kept flat.

The harrow, cultivator, and roller, are all more simple in their action and more easily managed than the plow. Harrowing is most effective when the horses step briskly along. The tines are then not merely drawn through the soil, but, in their combined swinging and forward movement, *strike* into it with considerable force. It is with reference to this that a single application of this implement is called a *stroke* of the harrows. Rollers are used to aid in pulverizing and cleaning the soil, by bruising clods and lumps of tangled roots and earth which the other implements have brought a-top; in smoothing the surface for the reception of small seeds, or the better operation of the scythe and other implements; and for consolidating soil that is too loose in its texture. Except for the latter purpose, light rollers are much superior to heavy ones. When it is wanted, for example, to bruise clods of quickens, that the after harrowing may more thoroughly free the roots from the adhering earth, a light cast-iron roller, say of five cwt., drawn by one horse, effects this purpose as thoroughly as one double the weight drawn by a pair,—and does it, moreover, in much less time, at less than half the expense, and without injuriously consolidating the free soil. These light rollers are conveniently worked in pairs, the plowman driving one horse and leading the other. With a pair of active horses, and such rollers, a good deal more than *double* the space can be rolled in a day, than by yoking them both to one heavy one of the same length of cylinder.

As a general rule, none of these tillage operations can be performed to advantage when the soil is wet. When rain falls inopportunistly there is a strong temptation to push on the field operations, before the soil has recovered the proper state of dryness. When this is done the farmer almost invariably finds in the issue that the more haste he makes the worse he speeds. Soils with a good deal of clay in their composition are peculiarly susceptible of injury in this way. Nice discrimination is needed to handle them aright. They require, moreover, a full stock of well-conditioned horses, that the work may be pushed rapidly through in favorable weather. To manage such soils successfully, especially when root crops are grown, tries the skill of the farmer to the utmost. So at least it has hitherto been; but with steam power to aid him, there is now a probability that the clay land farmer, by being able to break up his soil without treading it, and to get through with a large extent of tillage when his land is in trim for it, may find it practicable to grow root crops on equal terms with the occupier of freer soil.

When, by such operations as have now been described, land has been reclaimed from its natural state, and rendered fit for the purposes of the husbandman, it is everywhere so charged with the germs of weeds, most of which possess in a remarkable degree the power of reproduction and multiplication, that it is only by the most incessant and vigorous efforts he can restrain them from encroaching upon his cultivated crops, and regaining entire possession of the soil. He can do much towards this by ordinary tillage, and by sowing his crops in rows, and hoeing in the intervals during the early stages of their growth. But if his efforts are restricted to such measures only,

the battle will soon go against him. Besides this, all arable soils in which clay predominates, particularly when undrained, have such a determined tendency to become compact and soured, that under ordinary efforts they fail to yield a genial seed-bed. There is a necessity, therefore, for having recourse, from time to time, to that ameliorating process of lengthened tillage called fallowing. This process begins in autumn, immediately after the removal from the ground of the cereal crop, which had been sown upon the land newly broken up from clover lea or natural sward, and extends either to the time for sowing in the following spring, or is continued during the entire summer in preparation for autumn-sown wheat.

The object aimed at being the thorough disintegration and cleaning of the soil, the usual practice is to begin by plowing as deeply as is found practicable. This first or autumn furrow is accordingly turned over to a depth of 8 or 9 inches; or by using a stronger plow drawn by three or four horses, it is carried to 12 inches in depth; and in some cases, by following with a subsoil plow in the wake of the common one, the soil is stirred to the depth of 14 to 16 inches. All cultivators are agreed as to the importance of deeply and effectually disintegrating all soils that are naturally dry or thoroughly drained. In the case of undrained lands, and even of very unctuous clays, although well drained, such a deep stirring of the soil in autumn does but increase its capacity of retaining the rains of winter, and of being thereby more effectually soured, and it is therefore to be avoided. Assuming, however, that we have to do with soil thoroughly drained and moderately friable, it is undoubtedly beneficial to loosen it deeply and thoroughly at this stage. But before this deep plowing is set about, it will be worth while to consider well its bearing upon the cleaning part of the process. On carefully examining the fields at the time of reaping the grain crops, and from week to week thereafter, the roots of the couch-grass are found at first lying close to the surface; but instantly, on their getting the ground to themselves, they begin to send out fresh fibers, and to push their shoots deeply into the soil. In these circumstances, to proceed at once, according to the customary practice, to plow deeply, allows these weeds much time to increase, while this laborious and tedious operation is going on; and, although, when performed, it gives some present check to their progress, by burying them under a mass of loosened soil, it not only increases the difficulty of their after removal, but places them out of the reach of frost, and in the best possible position for pervading the entire soil, on the first recurrence of mild weather. The consequence is, that fallows so treated are invariably found in the spring more fully stocked with quickens than they were at the time of the autumn plowing.

The autumn tillage of the fallows having been accomplished in one or other of the ways described, the land is left untouched until the return of the spring. If it is infested by annual weeds, it is expedient, as soon as it is dry enough to bear treading with impunity to level and stir the surface by a turn of the harrows. This slight moving of the mellowed surface-soil induces the seeds of weeds to germinate more quickly than they would otherwise do, and thus a crop of them is got rid of by the next tilling. This preliminary harrowing is useful also in affording a level course for the tillage implements. By the time that the labor connected with the sowing of spring crops is over, the fallows are usually dry enough to be stirred with safety. This point must, however, be well seen to,

as irreparable mischief is often done by going upon them too soon. And now it is, that, instead of rigidly following any customary routine of so many plowings, harrowings, and rollings, the skillful cultivator will regulate his procedure by the actual circumstances of his soil, and the object which he has in view. What is needed for the successful growth of green crops is to have the soil free from weeds, thoroughly disintegrated to the depth of six or eight inches, and yet moist enough to insure the ready germination of seeds deposited in it. Where such autumn cleaning and manuring as we have described have been successfully carried out, all that is needed, in order to obtain a proper tilth, is to go to work with light grubbers, first in the line of the previous furrows and then across them, and then to harrow, roll, and remove any weeds that have been missed in autumn, after which the soil will be in the best possible condition for drilling. On friable soils, this method of performing the spring tillage by means of the grubber instead of the plow is perfectly practicable, and has manifold advantages to recommend it. The saving of labor is very great, as a man and pair of horses will more easily grub four acres than plow one acre. Weeds are more easily removed, as the grubber pulls them out unbroken, whereas the plow cuts them in pieces. The soil that has been all winter subjected to the mellowing influences of the weather, and which, in consequence, is in the best possible condition to yield a genial seed-bed, is retained a-top, whereas plowing buries it and brings up clods in its stead. And, lastly, the soil being merely stirred, without having its surface reversed, its natural moisture (or *winter sap*) is retained, whereby the germinating of seeds sown in it becomes almost a certainty. When once the ridgelets are made up in good condition, they can withstand a fall of rain with comparative impunity; and hence the occurrence of a course of fine weather, when the season is yet too early for sowing, is sometimes taken advantage of by preparing the land and making it up into ridgelets, although it should require to remain in this state weeks, or even months, before sowing takes place. In such a case, immediately before sowing, the ridgelets are first partially leveled by harrowing lengthwise, in order to loosen the soil and destroy annual weeds, and then again made up by using a double-breasted plow. We must here, however, insist upon the importance of having the grubbing thoroughly performed, which it cannot be unless the tines penetrate the soil as deeply as the plow has done at the autumn plowing. It is owing to the neglect of this that the system has failed in the hands of many farmers, who first mismanage the operation, and then throw the blame upon the grubbers. To insure success, the implement must be set so as to work at its full depth, sufficient motive power being applied by yoking three horses, if necessary, to each grubber at the first and also at the second going over, and there must be vigilant superintendence exercised lest the plowman do the work slightly. It is sometimes objected to this system of spring tillage, that it fails to rid the land of thistles and other tap-rooted weeds; but it is surely easier to fork these out as they appear, than to plow a whole field to destroy as many thistles as a man, it may be, would dig up in a day. By taking advantage of the tilth obtained by the action of the elements, instead of first plowing down the mellowed surface, and then attempting laboriously to reduce the obdurate furrows by mechanical means, skillful and energetic farmers now succeed in preparing even tenacious soils for drilled green-crops, at little expense, and with a good measure of certainty.

On these opposite classes of soil, then—the very loose and the tenacious—spring tillage, in preparation for root-crops, is performed to better purpose by means of the grubber than the plow. Betwixt these extremes, however, lies the most valuable class of soils—the strong fertile loams—on which the heaviest crops and best quality of swedes are grown. With these it is usually expedient to have recourse to at least one spring plowing, as soon, but only as soon, as the soil is dry enough to crumble freely to the very bottom of the furrow. As this usually occurs from four to six weeks before the time of sowing the crop, it is advisable to plow the entire field, and leave it so until rain falls, when a moderate use of the grubber, harrows and light roller, usually suffices to produce a good tilth for ridging. When operations are not thus facilitated by a seasonable fall of rain, it is necessary to proceed somewhat differently. The field is lying as it was left by the plow, with a rough dried surface. If harrowed while in this state, an abundant crop of clods is brought to the surface, which quickly harden when thus fully exposed to drought. To avoid this inconvenience, the field is first rolled with a heavy roller, and then grubbed across the direction in which it was last plowed. By this means the clods, being partially crushed and pressed down amongst the loose earth, resist the grubber, and are crumbled by it, instead of being merely raked out and left entire on the surface, as would happen but for this preliminary rolling. The grubbers are followed closely by harrows and a light roller, and these again by the grubbers; but this time with seven tines on instead of five, after which a sufficient tilth is usually obtained.

Having thus described at length that modification of the following process by which the soil is prepared for the sowing of green crops, we shall now, as proposed, speak of that prolonged form of it called a *summer* or *naked fallow*. From the facilities now afforded, by means of tile-draining and portable manures, for an extended culture of green crops, this laborious and costly process, which in its day was justly regarded as the very key to good and profitable farming, is now restricted to the more obdurate clay soils, or to cases where draining and modern improvements are neglected. The manifold advantages of having abundant crops of turnips, or mangel-wurzel, instead of naked fallow, sometimes tempt the occupiers of clay soils to push the cultivation of these crops beyond due bounds. We know of cases where, after large expenditure in draining, the cultivation of turnips has been carried to such an extent, and conducted so injudiciously, that the land has got foul and soured, and its gross produce has been reduced below what it was while the land was undrained, and under a regular system of all but exclusive naked fallows. However thoroughly drained, clay soils retain their ticklish temper, and are so easily disconcerted by interference during unfavorable weather, that the preparing of them for the cultivation of root-crops, and still more the removing of these crops when grown, is at best a hazardous business, and requires to be conducted with peculiar tact. Judicious farmers, who know by experience the difficulties that have to be overcome in cultivating such soils, are of opinion that all that can be ventured upon with safety is to prolong the period of the naked fallow's recurrence, rather than entirely to dispense with it. After a series of alternate grain and cattle crops, it is accordingly still their practice to wind up with a summer fallow, by which they rectify unavoidable defects in the tillage of preceding years, and put their land in good

humor for entering again upon a fresh course of cropping.

There are few agricultural facts more fully ascertained than this, that the growth, year after year, on the same soil, of one kind of plants, or family of plants, and the removal from it, either of the entire produce, or at least of the ripened seeds of such plants, rapidly impairs the general fertility of that soil, and, in particular cases, unfits it for bearing further crops of the kind by which it has been exhausted. The explanation of the causes of this phenomenon belongs to the agricultural chemist or vegetable physiologist, to whom we willingly leave the task. What we have to do with is the fact itself, and its important bearing on agricultural practice. There is no natural tendency in the soil to deterioration. If at any time, therefore, the earth fails to yield its increase for the use of man, it is owing to his own ignorance and cupidity, and not to any defect in the beneficent arrangements of the Creator. The aim, then, of the agriculturist, and the test of his skill, is to obtain from his farm abundant crops at a remunerative cost, and without impairing its future productiveness. In order to this, two conditions are indispensable,—first, that the elements of fertility abstracted from the soil by the crops removed from it be duly and adequately restored; and, second, that it be kept free from weeds. The cereal grains, whose seeds constitute the staple food of the human family, are necessarily the most important and valuable of our ordinary crops. The stated removal from a farm of the grain produced on it, and its consumption elsewhere, is too severe a drain upon its productive powers to admit of these crops being grown every year on the whole, or greater part of it, without speedily impairing its fertility.

No better rotation has yet been devised for friable soils of fair quality than the well-known four-field or Norfolk system. By this course half the arable lands are in grain crops, and half in cattle crops, annually. It is indeed true that, in the way in which this course has hitherto been usually worked, both grain and clover have recurred so frequently (every fourth year) on the same fields, that they have become subject to disease, and their produce excessively precarious. But the excellence of this course is, that its main features can be retained, and yet endless variation be introduced in its details. For example, instead of a rigid one-fourth of the land being each year under corn, barley, clover, and wheat or oats, respectively, half only of the barley division is frequently in practice now sown with clover seeds, and the other half cropped in the following year with some other product. On the same set of fields, coming around again to the same point, the treatment is reversed by the wheat, etc., and clover, being made to change places. An interval of *eight* years is thus substituted for one of *four*, so far as these two crops are concerned. Timothy unmixed with any other plant, is now frequently taken in lieu of clover on part of the division usually allocated to it, and proves a grateful change both to the land and to the animals which consume it.

MANURES.

In our remarks on tillage operations and on the succession of crops, we have seen how much the practice of the husbandman is modified by the kinds and amount of manures at his disposal. In describing the crops of the farm and their culture, frequent reference will also necessarily be made to the use of various fertilizing substances; and we shall, therefore, before proceeding to that department of our

subject, enumerate and briefly remark on the most important of them. In such an enumeration, the first notice is unquestionably due to farm-yard dung.

This consists of the excrements of cattle, their litter, and the refuse of their fodder; usually first trodden down in successive layers, and partially fermented in the farm-yard, and then removed to some convenient place and thrown together in heaps, where, by further fermentation and decay, it is reduced to a dark-colored, moist, homogeneous mass, in which state it is usually applied to the land. It is thus the residuum of the whole products of the farm, *minus* the exported grain, and that portion of the other crops, which, being first assimilated in the bodies of the live stock, is sold in the form of butcher-meat, dairy produce or wool. In applying farm-yard dung to land there is thus a returning to it of what it had previously produced, *less* the above exceptions, and such waste as may occur during the process of decay by gaseous exhalation or liquid drainage. It is obvious that the value of such dung as a fertilizing agent must depend much on two circumstances, viz.: *1st*, The nature of the food consumed by the animals whose excrements are mingled with it; and *2d*, The success with which waste from drainage and exhalations has been prevented. When cattle, in other days, were barely kept alive on straw and water during the winter months, and confined in an open yard, which, in addition to its share of rain, received also the drip from the eaves of the surrounding buildings—which, after percolating the litter, flowed unchecked into the neighboring ditch—it is needless to say that the dung resulting from such a process was all but worthless. It is much to be regretted that, from the faulty construction of farm-buildings, farmers still find it impossible to guard their dung-stores from injury and waste.

Next to the farm-yard manure, which must ever be looked to as the chief means of maintaining the fertility of a farm, guano claims our notice. This substance is the dung of sea fowl, and is found on rocky islets in parts of the world where rain seldom falls. The droppings of the myriads of birds by which such places are frequented have in many cases been permitted to accumulate during untold ages, and are now found in enormous deposits. The principal supply, both for quantity and quality, has hitherto come from the Chincha Islands, on the coast of Peru. The introduction of this powerful and exceedingly portable manure gave a prodigious impetus to agricultural improvement. It is about thirty years since a few casks of this article were shipped to Liverpool from Peru, where it has been known and prized as a valuable manure from the remotest periods.

Discoveries have from time to time been made of other deposits on the African coast and in Australia. The quality of both is much inferior to that from Peru. It is in a more advanced state of decay, and contains more moisture and sand. Great as was the deposit of this valuable fertilizer on the Chincha Islands, it rapidly diminished under the excessive demand for it from Great Britain and other countries. Gradually the quality became inferior, and in 1871 it was announced that this deposit was entirely exhausted. Considerable supplies are still obtained from other parts of the Peruvian coast; but unfortunately the quality is very inferior to that formerly obtained from the Chinchas. This circumstance would not be of much consequence if the guano was offered for sale on fair terms; but as the agents of the Peruvian government sell it only at one uniform price per ton, although different cargoes, and even different portions of any

one cargo, vary excessively in quality, it is now an unsafe article for farmers to purchase.

The dung of birds, from its including both liquid and solid excrements, is superior as a manure to that of quadrupeds. Pigeon dung has long been in high repute as an excellent fertilizer, and brought a high price when portable manures were scarcely to be had. It is now little heard of; guano, the excrement of fowls which feed upon fish, being superior, weight for weight. The dung of domestic poultry is usually mixed with the general dunghheap, but it could be turned to better account if kept by itself. It has been recommended to strew the floor of poultry-houses daily with sawdust or sand, and to rake this with the droppings into a heap to be kept under cover and used like guano.

It is now about sixty years since ground bones began to be used by farmers on the east side of England as a manure for turnips. At first bones were roughly smashed by hammers and applied in great quantities. By and by mills were constructed for grinding them to a coarse powder, in which state they continued to be used as a dressing for turnips, at the rate of sixteen to twenty bushels per acre, in all parts of the kingdom, and, to a very great extent, until the admirable discovery, by Baron Liebig, of the mode of preparing superphosphate of lime by dissolving bones in sulphuric acid. We shall not attempt to explain on chemical principles the wonderful superiority of this substance over simple bonedust in promoting the growth of the turnip plant. What we should do indifferently, by borrowing from others, will be found well done by various accomplished chemists who write specially on these subjects. In climates and seasons which may be characterized as moist and cool, guano will show best results, whereas in those which are rather hot and dry, superphosphate has the advantage. Accordingly we find guano the comparative favorite in Scotland, and its rival in the drier counties of England.

Guano is believed to encourage a great expanse of foliage, and to be more especially suited for early sowings; and superphosphate to influence development of bulb, and to deserve the preference for a later seed-time. The obvious inference is that, for the turnip crop at least, these valuable fertilizers should be used in combination; and actual experiment has verified its soundness. The use of them is universal and ever on the increase. They constitute also the standard by which farmers estimate the cost and effects of other purchased manures. The extent to which they are used, their high price, and the facility with which they can be adulterated with comparatively worthless ingredients, have led to almost unparalleled frauds. The adulteration of manures has, in fact, become a regular trade. Had farmers only their bodily senses to aid them, the detection of this fraud would be difficult—perhaps impossible. Here, however, they can call the chemist to their aid, with the certainty of ascertaining the real character of the articles which they are invited to purchase. If purchasers of manures would but insist in every instance on getting from the seller an analysis by some competent chemist, and along with it a written warranty that the stock is of the quality therein indicated, detection and punishment of fraud would be easy. In regard to superphosphate of lime, the farmer can purchase bonedust and sulphuric acid and prepare it himself. There is also great convenience in using the finest portion of the bone-dust for drying the other, as suitable material for this purpose is sometimes difficult to procure.

The homely process now described is quite inferior

to, and more costly than that pursued in factories, and should only be resorted to when a genuine article cannot otherwise be obtained.

Rape-cake reduced to powder forms an excellent manure for wheat and other crops. It is usually applied at the rate of from four to eight hundredweight per acre. The cakes resulting after oil has been expressed from camelina, hemp and cotton seeds, and pistachio and castor-oil nuts, from beech and other mast, all possess considerable value as manure, and were at one time available for that purpose. Most of them now command a price for cattle-feeding that forbids their use as manure unless when in a damaged state.

Common salt has often been commended as a valuable manure, but has never been used in this way with such uniform success as to induce a general recourse to it. We have already spoken of it as forming a very useful compound with lime and earth. It can also be used beneficially for the destruction of slugs, for which purpose it must be sown over the surface at the rate of *four* or *five* bushels per acre, early in the morning, or on mild moist days, when they are seen to be abroad. It is used also to destroy grubs and wireworm, for which purpose it is sown in considerable quantity on grass land some time before it is plowed up. It can be used safely on light soils, but when clay predominates, it causes a hurtful wetness, and subsequent incrustation of the surface. Its application in its unmixed state as a manure is at best of doubtful benefit; but in combination with lime, soot, nitrate of soda, and perhaps also superphosphate of lime, it appears to exert a beneficial influence.

Cubic saltpetre, or nitrate of soda, has now become one of our staple manures. The fertilizing power of common saltpetre or nitrate of potassa has been known from the earliest times, but its high price has hitherto hindered its use as a manure, except in the form in which it is obtained as refuse from the gunpowder mills. The cubic nitre is brought from Peru, where there are inexhaustible supplies of it. The principal deposits of nitrate of soda are in the plain of Tamarugal, at a distance of eighteen miles from the coast. The beds are sometimes seven or eight feet in thickness, and from these it is quarried with ease. It is not found in a perfectly pure state, but contains a mixture of several substances, chiefly common salt. To fit it for certain uses in the arts, it is subjected to a process of purification by boiling and evaporation. But for its use as a manure this is altogether unnecessary, and the cost would be greatly lessened if the nitrate were imported as quarried. As cubic nitre and guano contain very nearly the same percentage of nitrogen (the element to which the fertilizing power of manure is mainly due), it may seem surprising that the former should ever be used in preference to the latter. In practice, however, it is found that when applied as a top-dressing in spring, the former frequently yields a better profit than the latter; and hence the importance to farmers of getting it at a more reasonable price. Nitrate of soda is used as a manure for grain and forage crops. It is also extensively used as a top-dressing for wheat. For this purpose it is applied at the rate of eighty-four pounds per acre, in combination with two hundredweight of salt. The nitre and salt are thoroughly mixed, and carefully sown, by hand, in two or three equal portions, at intervals of several weeks, beginning early in March and finishing by the third week in April. If nitre alone is used, it has a tendency to produce over-luxuriance, and to render the crop liable to lodging and mildew. But the salt is found to correct

this over-luxuriance, and a profitable increase of grain is obtained.

Crude potash, or kianite, has of recent years been largely exported from Germany, and has been somewhat extensively used in combination with other manures for potatoes and other root crops—two hundredweight per acre being a common rate for the potash.

Besides those substances, the most important of which we have enumerated, which are available as manure in their natural state, there are various chemical products, such as salts of ammonia, potash, and soda, copper, sulphuric and muriatic acid, etc., which, in combination with lime, guano, night-soil, and other substances, are employed in the preparation of manures, with a special view to the requirements of particular crops. In some cases these preparations have been eminently successful, in others but doubtfully so. Many failures are probably due to the spuriousness of the article made use of; as it is known that enormous quantities of worthless rubbish have, of late years, been sold to farmers, under high sounding names, and at high prices as special manures.

In applying these concentrated manures, those only of a slow operating character should be used in autumn or winter, and at that season should invariably be mixed with the soil. Those in which ammonia abounds should in spring also be mixed with the soil when crops to which they are applied are sown. When used for top-dressing growing crops they should be applied only in wet weather.

All parts of the carcasses of animals form valuable manure, and are now carefully used in that way whenever they are unfit for more important use. The blood and other refuse from shambles and from fish-curers' yards, when mixed with earth and decomposed, make a valuable manure, and are eagerly sought after by farmers to whom such supplies are accessible. In London a company has been formed by whom the blood from the shambles is purchased, and employed instead of water in preparing superphosphate of lime, which, when thus manufactured, contains an amount of ammonia which adds considerably to its efficacy as a manure. In Australia and South America it has long been the practice to slaughter immense numbers of sheep and cattle for the sake of their hides and tallow only, there being no market for them as beef and mutton. To obtain the whole tallow, the carcasses are subjected to a process of boiling by steam and afterward to pressure, and are then thrown aside in great piles. This dried residuum is afterward used as a fuel in the furnaces of the steaming apparatus, and the resulting ashes constitute the bone-ash of commerce, which is now an important raw material in our manure factories.

The refuse from glue-works; the blubber and dregs from fish-oil; animal charcoal that has been used in the process of sugar-refining; the shavings and filings of horn and bones from various manufactories, and woolen rags, are all made available for manure.

Night-soil is a powerful manure; but owing to its offensive odor it has never been systematically used. Various plans are tried for obviating this objection, that most in repute at present being its mixture with charred peat. From the universal use of water-closets in private dwellings, the great mass of this valuable fertilizing matter now passes into sewers, and is carried off by streams and rivers, and is for the most part totally lost as a manure. When sewage water is used for irrigation, as in the neighborhood of Edinburgh, it is to the night-soil dissolved in it that its astonishing effects in promoting the growth

of grass are chiefly due. We have already expressed our views in regard to the use of it in this diluted form of sewage water. That mode of applying it is necessarily restricted to lands in the vicinity of towns. Hitherto the numerous and costly attempts that have been made to separate the fertilizing matter from the water in which it is contained have proved utter failures.

Along the seaboard large supplies of useful manure are obtained in the shape of drifted sea-weed. This is either applied as a top-dressing to grass and clover, plowed in with a light furrow, for various crops, or mixed in dung-heaps. It requires to be used in large quantities per acre—from forty to sixty loads—and is evanescent in its effects. Grain grown on land manured with sea-weed is generally of fine quality, and is in repute as seed-corn.

Crops of Buckwheat, Rape, Vetches and Mustard are sometimes plowed in, while in a green, succulent state, to enrich the land. It is, however, more usual to fold sheep on such crops, and so to get the benefit of them as forage, as well as manure to the land. The leaves of turnips are frequently plowed in after removing the bulbs, and have a powerful fertilizing effect.

Besides manure of an animal and vegetable origin, various mineral substances are used for this purpose. The most important and extensively used of these is lime. It is found especially beneficial in the reclaiming of moory and boggy lands, on which neither green nor grain crops thrive until it has been applied to them. Its use is found to improve the quality of grain, and to cause it in some cases to ripen earlier. It facilitates the cleaning of land, certain weeds disappearing altogether for a time after a dressing of lime. It is the only known specific for the disease in turnips called "fingers-and-toes," on which account alone it is frequently used in circumstances which would otherwise render such an outlay unwarrantable.

When bare fallowing was in use, it was commonly toward the close of that process that lime was applied. Having been carted home and laid down in large heaps, it was, when slacked, spread evenly upon the surface and covered in by a light furrow. It is now frequently spread upon the autumn furrow preparatory to root crops, and worked in by harrowing or grubbing, and sometimes by throwing the land into shallow ridgelets. Another method much used is to form it into compost with decayed quickens, parings from roadsides and margins of fields, etc., which, after thorough intermixture by frequent turnings, is spread evenly upon the land when in grass. A cheap and effectual way of getting a dressing of such compost thoroughly committed and incorporated with the surface soil is to fold sheep upon it, and feed them there with turnips for a few days. The value of such compost is much enhanced by mixing common salt with the lime and earth, at the rate of *one part* of salt by measure to *two parts* of lime. A mixture of these two substances in these proportions prepared under cover, and applied in a powdery state, is much approved as a spring top-dressing for corn crops on light soils.

Our remarks hitherto have had reference to carbonate of lime, in that form of it to which the term *lime* is exclusively applied by farmers. But there are other substances frequently applied to land which owe their value chiefly to the presence of mineral. The most important of these is marl, which is a mixture of carbonate of lime and clay, or with clay and sand, and other compounds. When this substance is found in the proximity of, or lying under, sandy or peaty soils, its application in considerable doses is attended with the

very best effects. As the composition both of peat and of clay marl varies exceedingly, it is always prudent, either by limited experiment or chemical analysis, of both substances, to ascertain the effect of their admixture. Lime is always present in those cases which prove most successful, but an overdose does harm.

Under some mosses and fresh water lakes extensive deposits of shell-marl are frequently found. It contains a larger percentage of lime than clay marl, and must be applied more sparingly.

Charred peat has been excessively extolled for its value as a manure, both when applied alone, and still more in combination with night-soil, sewage water, and similar matters, which it dries and deodorizes. So great were the expectations of an enormous demand for it, and of the benefits to result to Ireland by thus disposing of her bogs, that a royal charter was granted to a company by whom its manufacture was commenced on an imposing scale. This charcoal is doubtless a useful substance; but, as Dr. Anderson has proved, peat, merely dried, is a better absorber and retainer of ammonia than after it is charred.

Soot has long been in estimation as an excellent top-dressing for cereal crops in the early stage of their growth, and for grasses and forage plants. It is applied at the rate of fifteen to thirty bushels per acre. On light soils the addition of eight or ten bushels of salt to the above quantity of soot is said to increase materially its good effect. This mixture trenched, or deeply plowed in, is also recommended as one of the most powerful of all manures for carrots.

FENCES.

Fences, in agriculture, serve in general the three-fold purpose of inclosing animals on pasture-grounds, of protecting land from straying animals, and of affording shelter from cold winds. In countries where wood or stones are scarce, and more especially where the land has been long settled, hedges formed of various kinds of plants are common. These, when grown upon good soil, and when well kept and managed, give a clothed and picturesque appearance to the landscape. The hawthorn or white-thorn is the favorite hedge-plant in Britain, and the bois d'arc, or Osage orange, that of the United States.

Stone walls, when well constructed, form the best fences. The form and mode of building varies with the nature and quality of the stones. In new countries, where wood is abundant, the fences are all of this material. The snake fence, named from its zigzag form, is made by merely laying trees above each other, in such a manner that their ends overlap and cross, and require no additional fixing. As wood becomes more valuable, it is made into posts and rails. The posts are driven into the ground from two to three yards apart, and from four to five rails are nailed across, according to the purpose it is meant to serve. The stob and rafter fence is made by driving the posts in the ground at a distance of from three to four inches apart, and binding the whole by a rafter or rail nailed across the top. This is one of the strongest of wooden fences, but requires more material than the other. In America split rails, roughly sharpened at either end, and let into wide openings cut in the posts, are in common use.

LIVE STOCK—HORSES.

The breeding and rearing of domesticated animals have been carried to greater perfection than any other department of rural affairs. Observing the usual order, we notice first *Horses*.

Breeds.—Here we shall confine our attention to those breeds which are cultivated expressly for the labors of the farm; for although the breeding of saddle horses is chiefly carried on by farmers, and forms in some districts an important part of their business, it does not seem advisable to treat of it here. It is a department of husbandry requiring such a combination of fitness in the soil, climate, and inclosures of the farm, of access to first-class stallions, and of taste and judgment on the part of the farmer, that few indeed of the many who try it are really successful.

Breeding of Cart Horses.—In breeding cart horses regard must be had to the purpose for which they are designed. If the farmer contemplates the raising of colts for sale, he must aim at a larger frame than if he simply wishes to keep up his own stock of working cattle. These considerations will so far guide him as to the size of the mares and stallions which he selects to breed from; but vigorous constitutions, perfect freedom from organic disease, symmetrical form, and good temper are qualities always indispensable. Nothing is more common than to see mares used for breeding merely because, from lameness or age, they have ceased to be valuable for labor. Lameness from external injury is, of course, no disqualification; but it is mere folly to expect valuable progeny from unsound, misshapen, ill-tempered or delicate dams, or even from really good ones when their vigor has declined from age. A farmer may grudge to lose the labor of a first-rate mare for two or three months at his busiest season; but if he cannot make arrangements for doing this, he had better let breeding alone altogether; for it is only by producing horses of the best quality that it can be worth his while to breed them at all. It is always desirable that both sire and dam should have arrived at maturity before being put to breed.

The head of the cart horse should not be large, at least not heavy in the bones of the face and jaws, nor loaded with flesh. Full development of brain is, indeed, of great importance, and hence a horse somewhat wide between the ears is to be preferred. Prick ears and narrow forehead have by some been reckoned excellences, but we have so invariably noticed such horses to be easily startled, given to shying, and wanting in courage and intelligence, that we regard such a form of head as a defect to be avoided. The eye should be bright, full and somewhat prominent, the neck inclining to thickness, of medium length, and slightly arched, and the shoulders oblique. Upright shoulders have been commended as an advantage in a horse for draught, it being alleged that such a form enables him to throw his weight better into his collar.

Cart mares should not foal earlier than May. Provided they are not unduly pushed or put to draw heavy loads, they may be kept at work almost up to their time of foaling, and are thus available for the pressing labors of spring. It is of importance, too, that the pasture should be fresh, and the weather mild ere their nursing duties begin. Mares seldom require assistance in bringing forth their young, and although it is well to keep an eye upon them when this event is expected, they should be kept as quiet as possible, as they are impatient of intrusion, and easily disturbed in such circumstances. A sheltered place with good grass, and where there are no other horses, is the most suitable quarters for a mare that has newly foaled. There must be no ditch or pond in it, as young foals have a peculiar propensity for getting drowned in such places. A mare, in ordinary condition, receives the stallion on the ninth or tenth day after foaling, and with a greater certainty of conceiving than when it is delayed until she is again in

heat. If the mare's labor can at all be dispensed with, it is desirable to have her with her foal for two months at least. She may then be put to easy work with perfect safety, so that she is not kept away from the foal longer than two or three hours at a time. When the foal has got strong enough, it may even be allowed to follow its dam at her work, and to get suck as often as it desires it. Toward the end of September foals are usually weaned, and are then put under cover at night, and receive a little corn, along with succulent food. Good hay, bran, carrots, or swedes, and a few oats must be given regularly during the first winter, with a warm shed to lie in, and an open court for exercise. At weaning it is highly expedient to put a cavesson on colts, and lead them about for a few times. A few lessons at this early age, when they are easily controlled, saves a world of trouble afterward. Before being turned to grass in the spring, they should on the same principle, be tied up in stalls for a week or so. It is customary to castrate colts at a year old. When they have got familiar with the harness, they should be yoked to a log of wood and made to draw that up and down the furrows of a fallow field, until they become accustomed to the restraint and exertion, after which they may with safety be put to plow alongside a steady and good-tempered horse. As they should not have more than five hours' work a day for the first summer, it is always an advantage to have a pair of them to yoke at the same time, in which case they take half-day about, and do a full horse's work between them. With such moderate work and generous feeding their growth will be promoted. By midsummer, the press of field labor being over, it is advisable to turn the striplings adrift, and let them enjoy themselves in a good pasture until after harvest, when they can again be put to plow. Horses should not be required to draw heavy-loaded carts until they are five years old. When put into the shafts earlier than this they frequently get strained and stiffened in their joints. On every farm requiring four or five pairs of horses it is highly expedient to have a pair of young ones coming in annually.

CATTLE.

Breeds—1st, *Heavy Breeds*.—Without entering upon curious speculations as to the origin of these breeds, we proceed to notice them in the order suggested by their relative importance in practical agriculture. The large cattle thus claim our first attention, and among them we cannot hesitate in assigning the first place to the

Shorthorns.—It appears that from an early date the Valley of the Tees possessed a breed of cattle which, in appearance and general qualities, were probably not unlike those *quasi* shorthorns which abound in various parts at the present day. These *Durham*, *Teeswater* or *Shorthorn* cattle, as they were variously called, were soon eagerly sought after, and spread throughout Great Britain with amazing rapidity. For a time their merits were disputed by the eager advocates of other and older breeds, some of which (such as longhorns, once the most numerous breed) they have utterly supplanted, while others, such as the *Herefords*, *Devons*, and *Scotch polled cattle*, have each their zealous admirers, who still maintain their superiority to the younger race. But this controversy is meanwhile getting practically decided in favor of the shorthorns, which constantly encroach upon their rivals even in their headquarters, and seldom lose ground which they once gain.

It is said that the operations of an enterprising

Canadian breeder—Mr. Cochran of Hillhurst—have had a powerful effect in determining the extraordinary market rates for shorthorns of the choicest type. One cargo, including forty shorthorn bulls and heifers, and choice specimens of Cotswold sheep and Berkshire pigs, brought out by this gentleman in 1870, is said to have cost him \$75,000. American breeders of shorthorn cattle have now established a herd-book of their own, and have been so successful in their efforts that already they have made numerous sales to English breeders at long prices.

The *Hereford* is the breed which in England contests most closely with the shorthorns for the palm of excellence. They are admirable grazier's cattle, and when of mature age and fully fattened, present exceedingly level, compact and massive carcasses of excellent beef. But the cows are poor milkers, and the oxen require to be at least two years old before being put up to fatten—defects which, in our view, are fatal to the claims which are put forward on their behalf. To the grazier who purchases them when their growth is somewhat matured, they usually yield a good profit, and will generally excel shorthorns of the same age. But the distinguishing characteristic of the latter is that, when properly treated, they get sufficiently fat, and attain to remunerative weights at, or even under, 'two years old. If they are kept lean until they have reached that age their peculiar excellence is lost. From the largeness of their frame they cost more money, consume more food, and yet do not fatten more rapidly than bullocks of slower growing and more compactly formed breeds. It is thus that the grazier frequently gives his verdict in favor of *Herefords* as compared with shorthorns.

Dairy Breeds.—The *dairy breeds* of cattle next claim our attention, for although cattle of all breeds are used for this purpose, there are several which are cultivated chiefly, if not exclusively, because of their fitness for it. Dairy husbandry is prosecuted under two very different and well-defined classes of circumstances. In or near towns, and in populous mining and manufacturing districts, it is carried on for the purpose of supplying families with new milk. Where the soil and climate are more favorable to the production of grass and other crops than of corn, butter and cheese constitute the staple products of the husbandman. The town dairyman looks to quantity rather than quality of milk, and seeks for cows which are large milkers, which are long in going dry, and which can be readily fattened when their daily yield of milk falls below the remunerative measure. Large cows, such as shorthorns and their crosses, are accordingly his favorites. In the rural dairy, again, the merits of a cow are estimated by the weight and quality of the cheese or butter which she yields, rather than by the mere quantity of her milk. The breeds that are cultivated expressly for this purpose are accordingly characterized by a less fleshy and robust build than is requisite in grazier's cattle.

Farm Management of Cattle.—We shall now endeavor to describe the farm management of this valuable class of animals, under the heads of *breeding*, *rearing*, *fattening* and *dairy management*. The proceedings of those engaged in the breeding and rearing of cattle for the production of beef are, however, largely determined by the character of the soil and climate of particular districts and farms. The occupiers of all comparatively fertile soils carry forward to maturity such animals as they breed, and dispose of them directly to the butcher. Those who are less fortunately circumstanced in this respect, advance their young cattle to such a stage as the capabilities of their farms admit of, and then transfer them to

others, by whom the fattening process is conducted. It cannot be too strongly impressed upon those who engage in this business that it never can be profitable to breed inferior cattle; or (however good their quality) to suffer their growth to be arrested by cold or hunger; or to sell them in a lean state. In selecting a breeding stock of cattle, the qualities to be aimed at are a strong constitution and a symmetrical form, aptitude to fatten, quiet temper, and large milk-yielding power in the cows. As all these qualities are hereditary, cattle are valuable for breeding purposes not merely in proportion as they are developed in the individuals, but according to the measure in which they are known to have been possessed by their progenitors. A really good pedigree adds therefore greatly to the value of breeding stock. It is doubtless important to have both parents good; but in the case of ruminants, the predominating influence of the male in determining the qualities of the progeny is so well ascertained that the selection of the bull is a matter of prime importance. It is indeed miserable economy to grudge the price of a good bull. Coarse, misshapen, unthrifty cattle cost just as much for rearing and fattening as those of the best quality, and yet may not be worth so much by \$15 to \$25 a head when they come ultimately to market. The loss which is annually sustained from breeding inferior cattle is far greater than those concerned seem to be aware of. We must here protest against a practice by which shorthorn bulls are very often prematurely unfitted for breeding. Their tendency to obesity is so remarkable that unless they are kept on short commons they become unwieldy and unserviceable by their third or fourth year. Instead, however, of counteracting this tendency, the best animals are usually "made up," as it is called, for exhibition at cattle shows or for ostentatious display to visitors at home, and the consequence is that they are ruined for breeding purposes.

Cows are an expensive stock to keep, and it is therefore of importance to turn their milk to the best account. It is poor economy, however, to attempt to rear a greater number of calves than can receive justice. Seeing that they are to be reared for the production of beef, the only profitable course is to feed them well from birth to maturity. During the first weeks of calfhood the only suitable diet is unadulterated milk, warm from the cow, given three times a day, and not less than two quarts of it at each meal. By three weeks old they may be taught to eat good hay, linseed cake and chopped feed. As the latter articles of diet are relished and freely eaten, the allowance of milk is gradually diminished until about the twelfth week, when it may be finally withdrawn. The linseed cake is then given more freely, and water put within their reach. For the first six weeks calves should be kept each in a separate crib; but after this they are the better for having room to frisk about. Their quarters, however, should be well sheltered, as a comfortable degree of warmth greatly promotes their growth. During their first summer they do best to be soiled on clover or rye, with from one pound to two pounds of cake to each calf daily. When the green foliage fails, white or yellow turnips are substituted for it. A full allowance of these, with abundance of oat straw, and not less than two pounds of cake daily, is the appropriate fare for them during their first winter. Sheaf-oats may be fed during the months of spring, and this again will give place in due time to green foliage or the best pasturage. The daily ration of cake should never be withdrawn. It greatly promotes growth, fattening, and general good health, and in particular is a specific

against the disease called blackleg, which often proves so fatal to young cattle. Young cattle that have been skillfully managed upon the system which we have now sketched are at eighteen months old already of great size, with open horns, mellow hide, and all those other features which indicate to the experienced grazier that they will grow and fatten rapidly. This style of management is not only the best for those who fatten as well as rear, but is also the most profitable for those who rear only.

Fattening cattle are usually allowed to remain in the pastures to a later date in autumn than is profitable. The pressure of harvest, or the immature state of his turnip crop, often induces the farmer to delay housing his stock until long after they have ceased to make progress on grass. They may still have a full bite on their pastures; but the lengthening nights and lowering temperature lessen the nutritive quality of the herbage, and arrest the future accumulation of fat and flesh. The hair of the cattle begins to grow rapidly as the nights get chilly, and causes them to be housed with rougher coats than are then expedient. To avoid these evils the farmer should early in August begin to spread on the pasture a daily feed of green forage, consisting most usually of green corn cut from the ground, which supplies exactly the kind of food required to compensate for the deteriorating pasturage. The addition of a small quantity of chopped hay, or of corn-fodder to the other food, usually induces cattle to feed more eagerly. In short, the animals must be closely watched, and occasional variations made in the quantity and quality of the food given to particular individuals or of the general lot as their circumstances may require. Besides the food given in the manger it is desirable that each animal should receive a daily allowance of good hay in a rack to which he has access at pleasure.

A better appreciation of the effect of temperature on the animal economy has of late years exerted a beneficial influence upon the treatment of fattening cattle. Observant farmers have long been aware that their cattle, when kept dry and moderately warm, eat less and thrive faster than under opposite conditions. They accounted for this in a vague way by attributing it to their greater comfort in such circumstances. Scientific men have now, however, shown us that a considerable portion of the food consumed by warm-blooded animals is expended in maintaining the natural heat of their bodies, and that the portion of food thus disposed of is dissipated by a process so closely analogous to combustion that it may fitly be regarded as so much fuel. The fat which, in favorable circumstances, is accumulated in their bodies, may in like manner be regarded as a store of this fuel laid up for future emergencies. The knowledge of this fact enables us to understand how largely the profit to be derived from the fattening of cattle is dependent upon the manner in which they are housed, and necessarily forms an important element in determining the question whether yards, stalls, or boxes are best adapted for this purpose. A really good system of housing must combine the following conditions:

- 1st, Facilities for supplying food and litter, and for removing dung with the utmost economy of time and labor;
- 2d, Complete freedom from disturbance;
- 3d, A moderate and unvarying degree of warmth;
- 4th, A constant supply of pure air;
- 5th, Opportunity for the cattle to have a slight degree of exercise; and
- 6th, The production of manure of the best quality.

SHEEP.

When Fitzherbert so long ago said, "Sheep is the most profitable cattle that a man can have," he expressed an opinion in which agriculturists of the present day fully concur. But if this was true of the flocks of his time, how much more of the many admirable breeds which now cover the country. Their flesh is in high estimation with all classes of the community. Their fleeces supply the raw material for one of our most flourishing manufactures. They furnish to the farmer an important source of revenue, and the readiest means of maintaining the fertility of his fields.

Breeds.—The distinct breeds and sub-varieties of sheep are very numerous. We have no intention of describing them in detail, but shall confine our observations to those breeds which by common consent are the most valuable for their respective appropriate habitats. They may be fitly classed under three heads—viz., the heavy breeds of the plains, those adapted for downs and similar localities, and the mountain breeds.

Heavy Breeds.—Of the first class, the improved *Leicesters* are still the most important. Leicester rams are also more in demand than ever for crossing with other breeds. It is now about a century since this breed was produced by the genius and perseverance of Bakewell, in whose hands they attained a degree of excellence that has probably not yet been exceeded by the many who have cultivated them since his day. The characteristics of this breed are extreme docility, extraordinary aptitude to fatten, and the early age at which they come to maturity. The most marked feature in their structure is the smallness of their heads, and of their bones generally, as contrasted with their weight of carcass. They are clean in the jaws, with a full eye, thin ears and placid countenance. Their backs are straight, broad and flat, the ribs arched, the belly carried very light, so that they present nearly as straight a line below as above; the chest is wide, the skin very mellow, and covered with a beautiful fleece of long, soft wool, which weighs on the average from six to seven pounds. On good soils and under careful treatment these sheep are commonly brought to weigh from eighteen to twenty pounds per quarter at fourteen months old, at which age they are now usually slaughtered. At this age their flesh is tender and juicy; but when feeding is carried on till they are older and heavier, fat accumulates so unduly as to detract from the palatableness and market value of the mutton.

Lincolns.—These were at one time very large, ungainly animals, with an immense fleece of very long wool. By crossing them with the *Leicesters* the character of the breed has been entirely changed, and very greatly for the better. It is now, in fact, a sub-variety of the Leicester, with larger frame and heavier fleece than the pure breed. Their wool, however, retains its distinctive characteristics—viz., great length of staple, an unctuous feeling, and, in particular, a brightness or *luster* which adds largely to its value.

Cotswolds, sometimes called *Glo'sters* or *New Ox-fords*, are also large and long-wooled sheep, with good figure and portly gait. Great improvement has been effected in this breed during the last thirty years, in consequence of which they are rising in public estimation. The qualities for which they are prized are their hardiness, rapid growth, aptitude to fatten, and the great weight to which they attain.

Southdowns.—Not long after Robert Bakewell had begun, with admirable skill and perseverance, to bring to perfection his celebrated *Leicesters*, which have

either superseded or totally altered the character of all the heavy breeds, another breeder, Mr. John Ellman, of Glynde, in Sussex, equal to Bakewell in judgment, perseverance and zeal, and wholly devoid of his illiberal prejudice and narrow selfishness, addressed himself to the task of improving the native sheep of the downs, and succeeded in bringing them to as great perfection, with respect to early maturity and fattening power, as they are perhaps susceptible of.

These sheep are now usually classed as *Sussex Downs* and *Hampshire Downs*, the former being the most refined type of the class, both as regards wool and carcass, and the latter, as compared with them, having a heavier fleece, stronger bone and somewhat coarser and larger frame.

The *Shropshire* sheep, while partaking of the general characteristics of the *Southdown*, is so much heavier both in fleece and carcass, and is altogether so much more robust an animal, that it now claims to be ranked as a separate breed.

On arable farms, where turnips are grown, and a breeding stock of sheep regularly kept, it is usual to wean the lambs about the middle of July. When this has been done, the aged and faulty ewes are drafted out, and put upon good aftermath or other succulent food, that they may be got ready for market as soon as possible. In many districts it is the practice to take but three crops of lambs from each ewe. A third part of the brooding flock—viz., the four-year-old ewes—is thus drafted off every autumn, and their places supplied by the introduction of a corresponding number of the best of the ewe-lambs of the preceding year's crop. These cast or draft ewes are then sold to the occupiers of richer soils in populous districts, who keep them for another season to feed fat lambs. Such parties buy in a fresh stock of ewes every autumn, and, as they phrase it, "feed lamb and dam." In other cases the ewes are kept as long as their teeth continue sound, and after that they are fattened and sold to the butcher directly from the farm on which they have been reared. When the ewes that are retained for breeding stock have been thus overhauled, they are put to the worst pasture on the farm, and run rather thickly upon it. Attention is necessary, for some days after weaning, to see that none of them suffer from gorging of the udder. When it appears very turgid in any of them, they are caught and partially milked by hand; but usually the change to poorer pasturage, aided by their restlessness and bleating for want of their lambs, at once arrests the flow of milk. The time of admitting the ram is regulated by the purpose for which the flock is kept, and by the date at which fresh green food can be reckoned upon in spring. When the produce is to be disposed of as fat lambs, it is of course an object to have them early; but for a holding stock, to be reared and fattened at fourteen to sixteen months old, from September 20 to October 20, according to the climate of the particular locality, is a usual time for admitting rams to ewes. A few weeks before this takes place the ewes are removed from bare pasture, and put on the freshest the farm affords, or better still, on rape; failing which, one good feed of white turnips per diem is carted and spread on their pastures, or the ewes are folded for part of the day on growing turnips. The rams are turned in among them just when this better fare has begun to tell in their improving appearance, as it is found that in such circumstances they come in heat more rapidly, and with a greatly increased likelihood of conceiving twins. On level ground, and with moderate-sized inclosures, one ram suffices for sixty ewes; but it is

bad economy to overtask the rams, and one to forty ewes is better practice. Sometimes a large lot of ewes are kept in one flock, and several rams, at the above proportion, turned among them promiscuously. It is better, however, when they can be placed in separate lots. The breasts of the rams are rubbed with ruddle, that the shepherd may know what they are about. Those who themselves breed rams, or others who hire in what they use at high prices, have recourse to a different plan for the purpose of getting more service from each male, and of knowing exactly when each ewe may be expected to lamb; and also of putting each ewe to the ram most suitable to her in point of size, figure and quality of flesh and fleece. The rams in this case are kept in pens in a small inclosure. What is technically called a *teaser* is turned among the general flock of ewes, which, on being seen to be in heat, are brought up and put to the ram that is selected for them. They are then numbered, and a note kept of the date, or otherwise a common mark, varied for each successive week, is put on all as they come up.

The period of gestation in the ewe is twenty-one weeks. No lambs that are born more than twelve days short of this period survive. Before any lambs are expected to arrive a comfortable fold is provided, into which either the entire flock of ewes, or those that by their markings are known to lamb first, are brought every night. This fold, which may either be a permanent erection or fitted up annually for the occasion, is provided all round with separate pens or cribs of size enough to accommodate a single ewe with her lamb or pair. The pasture or turnip fold to which the flock is turned by day is also furnished with several temporary but well-sheltered cribs, for the reception of such ewes as lamb during the day. It is of especial consequence that ewes producing twins be at once consigned to a separate apartment, as, if left in the crowd, they frequently lose sight of one lamb, and may refuse to own it when restored to them, even after a very short separation. Some ewes will make a favorite of one lamb, and wholly repudiate the other, even when due care has been taken to keep them together from the first. In this case the favorite must either be separated from her or be muzzled with a piece of network, to prevent it from getting more than its share of the milk in the shepherd's absence. Indeed the maternal affection seems much dependent on the flow of milk, as ewes with a well-filled udder seldom trouble the shepherd by such capricious partialities. As soon as the lambs have got fairly afoot, their dams are turned with them into the most forward piece of seeds, or to rape, rye, winter oats, or water meadow, the great point being to have abundance of succulent green food for the ewes as soon as they lamb. Without this they cannot yield milk abundantly, and without plenty of milk it is impossible to have good lambs.

All sheep are liable to be infested with certain vermin, especially "fags" or "kaiids" (*Melophagus ovinus*) and lice. To rid them of these parasites various means are resorted to. Some farmers use mercurial ointment, which is applied by parting the wool, and then with the finger rubbing the ointment on the skin, in three or four longitudinal seams on each side, and a few shorter ones on the neck, belly, legs, etc. Those who use this salve dress their lambs with it immediately after shearing their ewes, and again just before putting them on turnips. More frequently the sheep are immersed, all but their heads, in a bath in which arsenic and other ingredients are dissolved. On being lifted out of the bath, the animal is laid on spars, over a shallow vessel so placed

that the superfluous liquor, as it is wrung out of the fleece, flows back into the bath. If this is done when the ewes are newly shorn, the liquor goes farther than when the process is deferred until the lambs are larger and their wool longer. It is a good practice to souse the newly-shorn ewes, and indeed the whole flock at the same time, in a similar bath, so as to rid them all of vermin.

The large flocks of sheep kept on the Western plains are Merinos, and only near markets for mutton is there much attention paid to the breeds above enumerated. The care of these great herds differs materially from that prescribed for small flocks, and the only product expected is wool.

SWINE.

A feature of prominent economic importance in the United States is the hog, the production of which has so enormously increased of late years that this country has become the source of supply of pork products for the entire civilized earth. The hog is the most cosmopolitan of all animals, except man, but his original habitat was undoubtedly the tropical regions of Asia. To this day swine are abundant in India, China and the islands of the Pacific, and throughout Europe from the extreme north to the shores of the Mediterranean. In many places various species run wild and are hunted for sport as well as for food. But it is as a farm animal that we have to treat of the hog in this place. The scientific definition of the genus and its allied species will be found elsewhere [see SWINE, Vol. VIII., page 5662, *et seq.*]. Of recent years great attention has been paid to the breeding of better-class swine and the old "razor-back" has become practically extinct. Swine are reared in every part of the Union, and, when properly managed, always at a fair profit. At the extreme north, in the neighborhood of large markets, and on such of the Southern plantations as are particularly suited to sugar or rice, they are not profitable, beyond the number required for the consumption of the coarse or refuse food produced. While pork remains at a moderate price, it can only be advantageously raised on a large scale on good soils, as it is such only that yield heavy crops of grain, roots, etc., which are essential to fattening it. Swine are profitable in connection with a dairy or orchard, as with little additional food besides what is thus afforded, they can be put into good condition for the butcher. It is on the rich bottoms, and other lands of the West, where Indian corn is raised in profusion, and at small expense, that they can be reared in the greatest numbers and yield the largest profit. The extensive and fertile States west of the Alleghenies have for many years taken the lead in the production of swine; and it is probable their climate and soil, which are peculiarly suited to their rapid growth, as well as that of their appropriate food, will enable them forever to remain the leading pork producers of the North American continent.

On butter-farms, where there is a large quantity of skimmed milk that is not worth while to make into cheese, almost the only means of disposing of this valuable material is to feed it to swine. And it should be the care of the farmer to regulate the number kept as closely as possible by the quantity of milk that can be supplied to them, unless his circumstances would justify his feeding them largely with grain or purchased food, which is not always the case.

Where the supply of skimmed milk is depended upon as the chief food of these animals, it is better to keep breeding sows, coming in at different times, so

that, for as large a part of the year as possible, there may be young pigs to be fed, as these convert the milk more rapidly into flesh than the older animals. Generally, in well-settled neighborhoods, and in the vicinity of towns, the price paid for weaning-pigs is much greater in proportion to their weight than that paid for fat hogs.

If it is considered profitable, owing to the low price of grain, or the probable high price of pork, to feed grain, it will be found better in all cases to steam this, or otherwise to cook it. If it is previously ground the profit will be still greater. Especially if it is not to be steamed or cooked, all except nubbins and waste grain should be finely ground and soaked in water before feeding. There will be an economy of fully one-third of the food if it is properly cooked before being given to the animals. If there are no facilities for cooking or steaming, it is a good plan to mix the meal with hot water, and to leave it a few hours in a covered barrel, or other closed vessel, before feeding it.

The breeds of swine cultivated in this country are numerous, and, like our native cattle, they embrace many of the best and a few of the worst to be found among the species. Great attention has for many years been paid to their improvement in the Eastern States, and nowhere are there better specimens than in many of their herds. This spirit has rapidly extended westward and southward, and among many of the intelligent farmers, who make them a leading object of attention, on the rich corn grounds of the West, the swine have attained a great degree of excellence. This has been accomplished by the introduction and perpetuity of some of the distinct races, and in the breeding up to a desirable size and aptitude for fattening, from such meritorious individuals of the breeds, or their crosses, as have come within their reach.

Swine should not be allowed to breed before twelve or fifteen months old, unless the animals are large and coarse, when they may be put to it somewhat younger. Not only choice individuals, but such as are well descended, should be selected for the purpose of breeding. The sow should be in good condition, but not fat, nor approaching to it, and a proper degree of exercise is essential to the development of the fetus and the health of the parent; for which reason she should have an extended range connected with her pen. The sow goes with young about 114 days. A week before her time comes round a comfortable, quiet place should be prepared for her under cover, and well protected from cold, if the weather be severe, or if warm, a range in a pasture with an open shed to retire to, is sufficient. Too much litter for bedding must be avoided, and no change or disturbance of the sow permitted till two or three weeks after pigging, as the restlessness thereby produced may result in the loss of the pigs. The sow should be fed only with a small quantity of the lightest food or thin gruel for two or three days, and not put on full feed for a week. If inclined to eat her pigs, she should be fed two or three times with raw pork or fresh meat. The pigs may be taught to crack oats or soaked corn after three or four weeks, but those or any other grains are much better for being ground, and corn cooked, if possible. Milk is the best food to wean pigs on, where it can be had, and meal mixed gradually as they grow older. The pigs, at this time, should be provided with a trough inaccessible to the dam; they will soon be able to feed on milk and other food, preparatory to weaning. This may take place when they are eight or ten weeks old, and to prevent injury to the sow, let one or two remain with

her a few days longer, and when finally removed, if her bag appears to be full, they may be allowed to drain the milk after twenty or thirty hours. The sow should be restricted to a light dry diet for a few days. At six or eight weeks old, the male pigs, intended for pork, should be castrated.

In the rich corn regions of the Western States, the old wasteful way of turning swine into the cornfields to fatten is now mostly discontinued from the increased value of the harvested grain, and it is fed to them from the harvest wagon, or crib. But penning them under shelter, and grinding and cooking the food, would be more economical. If fattened early in the season, they will consume less food to make an equal amount of flesh than in colder weather; they will require less attention, and generally early pork commands the highest price in market.

THE POULTRY YARD.

Poultry is a class of stock deserving more attention than farmers generally give it. There are, indeed, few farm-yards untenanted by fowls of some sort, and few homesteads without a poultry-house. It is rare, however, to meet with an instance where the breeding and management of poultry is conducted with the care and intelligence so frequently bestowed on other kinds of live stock. Now, if poultry is kept at all, whether for pleasure or profit, it is surely worth while to use rational means for securing the object in view. To have good fowls, it is necessary to provide a dry, warm, well-ventilated house, in which they may roost and deposit their eggs. This house must be kept clean, and its tenants regularly supplied with abundance of suitable food. Constant and careful attention is also absolutely indispensable. On farms of the lesser sort, this duty is usually undertaken by the farmer's wife or daughters. It will, however, in most cases be better to intrust the entire charge of the poultry to some person who will give undivided attention to it.

The kinds of poultry most suitable for a farm-yard are the common fowls, geese and ducks. Turkeys and guinea fowl are difficult to rear and troublesome to manage, although profitable under good auspices. Of the common fowl there are now many excellent and distinct breeds. The *Cochin China* or *Shanghai* is the largest breed we have. They are hardy and very docile; their flesh is of good quality when young; their eggs, of a buff color, are comparatively small but excellent in flavor, and are produced in great abundance. The hens resume laying very soon after hatching a brood; sometimes as soon as three weeks. They are the more valuable from the circumstance that their principal laying season is from October to March, when other fowls are usually unproductive. The *Dorkings*, of which there are several varieties, as the speckled, the silver, and the white, are not excelled by any breed for general usefulness. The hens are peculiarly noted for their fidelity in brooding, and their care of their young. The *Spanish fowls* are very handsome in their plumage and form, have very white and excellent flesh, and lay larger eggs than any other breed. The *Polish* and *Dutch every-day layers* are peculiarly suitable where eggs rather than chickens are desired, as the hens of both these breeds continue to lay for a long time before showing any desire to breed.

It is to be recommended that, except in situations where a good price can be got for chickens, the return should be sought for chiefly in eggs.

A suitable stock of fowls being selected, pains must be taken to preserve their health, and other good qualities, by breeding only from the best of both

sexes, and these not too near akin. A very simple plan for securing this is to select a cock, and not more than six or eight hens, of the best that can be got, and then to use only the eggs from these selected fowls for the general hatching. There are many advantages in such a course. The whole stock of fowls can thus be had of uniform character and superior quality. Besides having the run of the barn-floor and stack-yard, fowls are greatly benefited by having free access to a pasture or roomy grass-plot. If the latter is interspersed with evergreen shrubs so much the better, as fowls delight to bask under the sunny side of a bush, besides seeking shelter under it from sudden rain. Their court should also be at all times provided with clean water, and a heap of dry sand or coal ashes, in which they wallow, and free themselves from vermin. To keep them in profitable condition, they require, besides scraps from the kitchen and refuse of garden stuffs, etc., a daily feed of barley or corn. In cold weather they are the better for having some warm boiled potatoes thrown down to them, as also chopped liver or scraps of animal food of any kind. There is an advantage in having the poultry-house adjoining to that in which cattle food is cooked in winter, as, by carrying the flue of the furnace up the partition wall, the fowls get the benefit of warmth thus imparted to their roosting place. Sawdust, dried peat, or burnt clay are suitable materials for littering poultry houses, and are preferable to straw. By strewing the floor with such substances two or three times a week, each time carefully removing the previous application, and storing it with the mingled droppings of the fowls *under cover*, a valuable manure can be secured. When 100 common fowls, a score of geese, and a dozen or two of ducks are kept, the quantity and value of the manure produced by them, if kept by itself and secured from the weather, will surprise those who have not made trial of such a plan.

Treatment of Live Stock Under Disease.—Time was when every such treatise as the present was expected to contain a description of the diseases to which the domesticated animals are most subject, and instructions for their treatment under them. But now that farriery is discarded, and veterinary medicine is taught in colleges, the handling of such a subject is obviously beyond the province of a practical farmer. A few general observations are all, therefore, that we offer regarding it. The province of the stockmaster obviously is to study how to prevent disease rather than how to cure it. For this end let him exercise the utmost care, first, in selecting sound and vigorous animals of their respective kinds, and then in avoiding those errors in feeding and general treatment which are the most frequent causes of disease. When cases of serious disease occur, let the best professional aid that is available be instantly resorted to; but in all those cases which farmers usually consider themselves competent to treat, we advise that they should trust rather to good nursing, and to the healing power of nature, than to that indiscriminate bleeding and purging which are so commonly resorted to, and which in most cases do harm instead of good.

PLANTATION AGRICULTURE.

Under this head there are certain products chiefly limited to the Southern States, not properly coming under agriculture in the usual sense. The chief products of this field are cotton, tobacco, sugar and rice, which will be briefly considered.

Cotton is the produce of all the species of the genus *Gossypium*, which belongs to the natural order *Malvaceae*, and is thus allied to Mallow, Hollyhock, Hi-

biscus, etc., the general resemblance to which is very apparent both in the foliage and flowers. The species are natives of the tropical parts of Asia, Africa and America, but their cultivation has extended far into the temperate zones. They all have leaves with three to five lobes, which, in a very young state are often sprinkled with black points and rather large flowers, which are mostly yellow, but sometimes in whole or in part purple; the flowers very soon fall off; they grow singly from the axils of the leaves, and are surrounded at the base by three large heart-shaped, cut or toothed, involucre leaves or bracts, partially growing together as one. The fruit is a 3–5-celled capsule, springing open when ripe by 3–5 valves, and containing numerous seeds enveloped in cotton which is generally white, but sometimes yellow, and issues elastically from the capsule after it has burst open.

The beautiful long-stapled silky wool known as “Sea Island” is grown exclusively upon the islands and a portion of the mainland of Georgia, South Carolina, and Florida; the saline ingredients of the soil and atmosphere being indispensable elements of the growth. The plant bears a yellow flower, and the seeds are small, black, and quite smooth, and the wool is easily separated therefrom; but when sown far inland, away from the saline influences of the coast, the seeds increase in size, and become covered with innumerable short hairs. A large percentage of the crops raised in Alabama, Louisiana, Mississippi, Texas, etc., are also varieties of this species, though owing to climatic influences, the wool is shorter in staple, and less easily separated from the seeds than Sea Island. The short-staple varieties, known as New Orleans, Mobile, etc., are standard cottons. *G. herbaceum* is found in India, China, Egypt, etc. The principal commercial varieties are those known as Surat, Madras, and short-stapled Egyptian. It is a small shrubby plant, bears a yellow flower, the seeds are covered with short grayish down, and the staple produced, though not long, is very fine. Its price varies from 3½d. to 9d. per lb. A variety is cultivated in the United States, and the cotton known as nankeen is thought to belong to this species. *G. herbaceum* can be profitably cultivated in colder countries than any other species of cotton plant. The third species is a native of South America, and the “green seed” cotton of the United States appears to be a variety. The stem reaches 10 to 15 feet in height, the flowers are yellow, and the capsules contain eight or ten black seeds firmly attached together in a cone-like mass. The wool is long and strong-stapled, and in value stands next in order to Sea Island and long-stapled Egyptian. Maranhão, Bahia, and Maceio are varieties which sell in Liverpool at from 8d. to 1s. 2d. per lb. *G. arboreum* is found in India, China, etc., and, as its name imports, is a large tree-like plant. It bears a red flower, and produces a fine yellowish-white wool. Varieties of it have been long cultivated in the United States, and with the requisite soil and climate, are said to produce a wool somewhat resembling Sea Island.

2. *Cultivation.*—The plant is a very delicate organism, and requires a peculiar soil and climate for its due development. The method of cultivation is much the same in the various countries; but the most perfect system is that which obtains in the United States of America. Although the plant is not, strictly speaking, an annual, it is found more profitable to destroy the shrub after the crop is gathered, and sow new seed every year. The preparation of the land takes place during the winter months. After the ground has been thoroughly plowed, and as soon as

all symptoms of frost have disappeared, the soil is laid off into rows varying in width from 3 to 4 feet, according to the situation and quality of the soil. The seed is then sown along the center of the beds in a straight furrow made with a small plow or opener. The sowing commences in March, and generally continues through April; but sometimes, owing to late spring frosts, the planting is prolonged to May. The young shoot appears above ground in about eight to ten days, and is then and subsequently weeded and thinned. Blooming takes place about the beginning of June—in early seasons, towards the latter end of May; the average date is about June 5. As a general rule, cotton is a dry-weather plant. For plowing, the planter requires just sufficient rain to give the soil a moist and spongy texture. During the early stages of its growth, the crop flourishes best with a warm steamy sort of weather, with an occasional shower until blooming; too much rain being productive of weeds and wood at the expense of wool, while a severe drought produces a stunted plant, forced into too early maturity, and resulting in a small and light-stapled crop.

From the date of blooming to the close of the picking season, warm, dry weather is essential. Picking generally commences in August, occasionally in July, and continues until the occurrence of frost—about the end of October or beginning of November—puts a stop to the further growth of the plant. All the available hands of the plantation, young and old, are called into full employment during the harvest. The cotton is gathered into baskets or bags suspended from the shoulders of the pickers, and when the crop has been secured, it is spread out and dried, and then separated from the seeds. The latter process was formerly performed by hand—a tedious operation, by which one hand could clean only a pound or so a day; but since the invention of the saw-gin, by Eli Whitney in 1793, the process of cleaning has been both rapid and effectual.

The United States produce more than half the cotton grown in the world, although they only commenced the business about one hundred years since.

Of the total quantity of cotton imported into Europe in 1860, no less than 83.9 per cent. came from the United States. For a number of years it had averaged about 75 per cent. This virtual dependence of a vast industrial system upon one source of supply for the raw material necessary to keep its labor and machinery fully employed, had long been regarded with considerable anxiety; the more so as it was known that sooner or later a great crisis would, for a period of more or less duration, dislocate the agricultural industry of the South; but all attempts to escape from so undesirable a state of things were frustrated by the one important fact that no other cotton-producing country had been able successfully to compete with America in either quality or price. The war, by raising values to a famine level, led to a largely increased production of cotton in India, Egypt, South America, etc.; but even after the conflict had lasted four years, scarcely half of the decrease in the imports from the South had been made up by increased receipts from all the world besides.

Tobacco.—The two principal species under cultivation with their varieties are *N. Rustica*, grown in the colder portions of Europe, and *N. Tabacum*, cultivated in the United States; of this latter, the Cuba and the Connecticut seed leaf are the varieties principally cultivated in the United States for cigars. Of the manufacturing tobaccos there are innumerable varieties. The principal States for the production are

Virginia, Kentucky, Tennessee, Missouri and Ohio. Of the sections named, Kentucky produces by far the largest quantity. The cotton States produce but little tobacco, but at the centennial exposition twenty-one States were represented, which besides the hung leaf exhibited ninety specimens of pressed leaf, the best sample being from Virginia and valued at four dollars per pound. In cigar tobaccos, Connecticut produces the best, and Wisconsin the next best tobacco, if we may except Florida, which produces comparatively but a small quantity, but of a high grade for wrappers and fillers to cigars.

The cultivation of the crop is well understood in the tobacco regions, the chief labor of which consists in the operation of "worming" often repeated, and in "curing," on the perfection of which the price often depends.

The consumption of tobacco rapidly grows as time passes. The number of smokers is at least 30 per cent. of the population of the world. In the United States the consumption is about 4½ pounds per head. In Europe it is about 2½ ounces of smoking tobacco per week per head.

Readily acclimatized in regions comparatively cold, there is no reason why tobacco culture as an industry should decline in the United States. In many regions, as in the Connecticut valley, Missouri and California, it has ceased to be a plantation crop.

The quantity of tobacco manufactured in the United States in 1900 was 719,847,857 lbs. (of which 171,120,784 lbs. were grown in Kentucky); and in 1881–90 the average crop was nearly 400,000,000 lbs. The value of a year's crop in 1880–90 varied from \$30,000,000 to \$45,000,000. The inland revenue receipts alone reach some \$34,000,000. The exports of manufactured tobacco from the United States in 1901 amounted, with stems and trimmings, to 315,787,782 lbs., valued at \$27,656,475; and of manufactured tobacco, including cigars and cigarettes, the value in the same year was \$5,092,603. The imports of tobacco in 1901 were (unmanufactured) worth \$16,290,387, besides 1,250,218 lbs. of cigars, etc., worth \$2,480,139. Prior to 1890 the import duties ranged from 40 cents to \$2.50 + 25 per cent. *ad valorem*, but under the McKinley tariff they range 35 cents to \$4.50 + 25 per cent. *ad valorem* per lb.

Sugar.—Sugar-cane was grown as early as the 12th century, and the ancients called it, as a curiosity rather than an article of commerce covering a large field of human industry, "honey in reeds." Chemically, there are many varieties of sugar, notably that which we know as "glucose" or "grape" sugar, and "cane" sugar. Only the latter is considered in this article.

Besides the cane, beet sugar, and the cultivation of the beet for sugar-making purposes, has obtained a considerable foothold in the United States. The sugar-cane is subject to climatic conditions ruling only in a small district in the extreme southern States. It has always been held, and seems unfortunately to be a fact, that sugar-cane culture cannot be made profitable without slave-labor. Ordinary laborers will not work in a climate so unhealthy as a sugar-cane climate must necessarily be. Consequently, since the emancipation of the slaves in the United States the sugar industry, if it has not declined, has not increased.

The planting and cultivation of the sugar-cane varies with the condition of climate. In the great sugar-producing country of Cuba the cane is planted with slips of cane, containing the joints and "eyes," laid lengthwise in the furrow. The canes growing

from these are cut for crushing, and new canes grow up for the next crop from the same roots, the process usually continuing for six or eight years without re-planting. Whatever the mode of planting, the ground is prepared as it would be for corn, and the cultivation of the cane is almost precisely the same as it would be for that cereal.

The northern limit of cane sugar production in the United States may be given as belonging to Florida and the gulf region of Georgia, Alabama, Mississippi, Louisiana and Texas. The manufacture can never be profitably carried on outside the Gulf States. Even Louisiana gives only 1,200 to 1,800 pounds of sugar per acre, while in the West Indies, 3,000 and even 5,000 pounds per acre is produced, and in the Mauritius, and in the East Indies the product sometimes runs up to 7,000 per acre. There are twenty-four principal sugar countries in the world, six of these are European ones in which are produced beet sugar to over one-half the amount of the entire cane-sugar production of the whole world.

Rice.—As a food, rice has only half the value of wheat, yet it feeds one-third of the human race. The culture of it began in the United States by accident in 1694, a small bag of it from a distressed vessel which had put into the port of Charleston being experimentally planted in gardens in that vicinity.

Its advantage in agriculture is that it can be grown in lands so wet as to be unfit for all other uses, and it is this variety of the plant, known as "lowland rice" that is exclusively produced in this country. The product is of excellent quality, due to excellence of modes of cultivation. The chief expense in rice-culture is in ditching and otherwise preparing the fields where it is to be grown. After the sowing the water is turned on the field and allowed to remain until the grain has sprouted and has grown to the surface of the water. Then the water is allowed to run off again, to be again turned on at a certain period in the growth of the plant, and so remains until the latter is mature. This is a substitution of irrigation for cultivation, since the water kills all ordinary weeds. When the grain is yellow the water is again turned off, and the crop is harvested. Thrashing, winnowing and marketing follow, as in the case of wheat or other cereals. Rice-culture has little in common with the processes of agriculture, and may be considered the product of special conditions entirely antagonistic to it in all other departments.

FARMING AS A TRADE.

The amount of capital that is required in order that the business of farming may be conducted advantageously is largely determined by the nature of the soil, etc., of each farm, the system of management appropriate to it, the price of stock and of labor, and the terms at which its rents are payable.

But the mere possession of capital does not qualify a man for being a farmer, nor is there any virtue inherent in a lease to insure its success. To these must be added probity, knowledge of his business, and diligence in prosecuting it. These qualifications are the fruits of good education (in the fullest sense of that term), and are no more to be looked for without it than good crops without good husbandry. Common school instruction will, of course, form the groundwork of a farmer's education; but to this should be added, if possible, a classical curriculum. It has been the fashion to ask, "Of what use are Greek and Latin to a farmer?" Now, apart from the benefit which it is to him, in common with other men, to know the structure of language, and to read

with intelligence the literature of his profession, which more and more abounds in scientific terminology, we believe that no better discipline for the youthful mind has yet been devised than the classical course which is now in use in the universities. Of this discipline we desire that every future farmer should have the advantage. But the great difficulty at present lies in finding appropriate occupation for such youths between their fifteenth and twentieth years. In many cases the sons of farmers are during that period put to farm labor. If they are kept steadily at it, and are made proficient in every kind of work performed on a farm, it is a good professional training as far as it goes. The more common one—at least as regards the sons of the larger class of farmers—which consists of loitering about without any stated occupation, attending fairs and markets, and probably the race-course and hunting-field—is about the most absurd and pernicious that can be well imagined. Such youths are truly to be pitied, for they are neither inured to bodily labor nor afforded the benefits of a liberal education. It need not surprise any one that such hapless lads often prove incompetent for the struggles of life, and have to yield their places to more vigorous men who have enjoyed the benefit of "bearing the yoke in their youth." Unless young men are kept at labor, either of mind or body, until continuous exertion during stated hours, confinement to one place, and prompt obedience to their superiors, have ceased to be irksome, there is little hope of their either prospering in business or distinguishing themselves in their profession. Owing to the altered habits of society, there is now less likelihood than ever of such young persons as we are referring to being subjected to that arduous training to bodily labor which was once the universal practice; and hence the necessity for an appropriate course of study to take its place.

In the United States, associations for the promotion of the science of agriculture are very numerous, embracing in their scope the interests of agriculture proper, horticulture, stock-raising, dairying, bee-keeping, fish-culture, and kindred industries, and ranging in importance from the Government Department of Agriculture at Washington (established in 1862) to the ordinary country fair for the exhibition of domestic products. Almost every State and Territory has its general agricultural society, while numerous inter-state, sectional, and county associations abound, having for their object the promotion of agricultural interests.

The cause of agricultural education and instruction in the mechanic arts in the United States has received liberal encouragement by grants of public lands by Congress. In 1862 an act was passed presenting to each State, which may provide colleges for these purposes, 30,000 acres of the public domain for each senator and representative in Congress, to be applied exclusively to education. The States availed themselves of the offer, and about fifty colleges of industrial education (generally embracing a course in agriculture) have been established, either as distinct institutions or departments of institutions previously in existence. The systems of instruction in these institutions vary, but in general embrace—in addition to the studies usually pursued in schools of this grade—agricultural chemistry, with qualitative and quantitative analysis of soils and fertilizers; practical agriculture, including the subjects of soils, drainage, irrigation, and fertilization; experimental farming, fruit culture, floriculture, market-gardening, landscape-gardening, farm crops, farm implements, farm

animals, veterinary science, vegetable physiology, zoölogy, entomology, etc.

Yet the phrase, "Farming as a trade," has a different significance in the United States from what it has in any other land. In all others, farming is a thing to choose, amid old surroundings and well-established customs. Facts are all familiar. He who wishes to adopt the profession does so with an entire understanding of what its requirements are. But in America farming has always largely meant pioneering. No band of settlers in a new region could know what it best produced, or how to best produce that best. The American of every pursuit is a man who usually has himself seen the change from a wilderness to a garden in several instances. He has seen cities grow and markets rise "from the raw," to use his current phrase. As a rule the thing intended and expected has not come, and the entirely unexpected has happened.

But as it has been a story of change, so has it been of astonishing progress. A brief review of the story will show us where we stand. Englishmen have always known how to farm, yet England's first attempt in America was a blind disregard of all that could make this country valuable to England. She sent to Jamestown not farmers, but "gentlemen." They failed to hew away the primeval trees, or to grub out the roots, or to delve with the rude and clumsy implements of that day for a sustenance they knew would surely come did they but work. On the contrary, they loaded a ship with what was either iron pyrites or broken mica, and sent it back to England, a specimen of the "fool's gold," whose story is really older than Jamestown and runs through the human race. Then they proceeded to lie down in their cabins and die of hunger, all save a remnant who were kept alive until food came by water again, by the "corn" they begged or stole from the "naturales" of the wilderness. Then they learned the old lesson over again, that wherever a man will delve and plant there he may live, and there only. Plymouth, on the other hand, delved from the beginning. It was hard at first, but the colony was self-supporting after the first year, and that rude shore, with its unkind soil and its rocky hills, gave them back content, happiness, their idea of liberty, and all they came for.

Then came a time that has continued to this day; the time when the young men "struck out" to go westward, and continually westward. There was nothing to go for but land, and they had learned that the gold lay in the soil, not in mines, but everywhere. They carried their rude implements with them, and *what they had not they invented*. In this single sentence is the story of a hundred and eighty years. Wherever they went they lived from the beginning. They found new climates, new soils, new products, and they continually adopted new ideas. This process of adoption is going on yet. The new lands and climates west of the Mississippi are most unlike the lands and climates of the east. The soil would in most cases serve as a fertilizer to those on which the grandfathers of its inhabitants demonstrated that farming pays. The colonial plow became a curiosity sixty years ago. The spade was thrown away or became a new steel tool better in gracefulness of form and lightness of use and compact utility than was Captain Miles Standish's sword.

Hewing away the primeval forests, the old straight-handled clumsy axe changed itself into that admirable tool which has no rival, and which even Mr. Gladstone uses and states he is glad to handle. The old hoe, clumsy and shoulder-breaking, long since became

the thin, keen, shining tool which cuts. The plow became something that could be pulled out backwards and swung around a stump, whose moldboard shed the soil in even masses, and shone with its own use. The ancient sickle, stolen from a statue of Ceres, became toothed, and then was thrown away for the "cradle," the crooked handle for which the pioneer found first in the woods, which was next twisted and made to grow to suit him when he should want it, and which finally became a steam-bent piece of elegantly tapering ash, fastened to its scythe and fingers with bolts that were dainty specimens of the smith's ancient craft, and sold complete to the farmer for two dollars and fifty cents.

Yet these were but the infantile stages of what may be called the thoughtful side of agriculture, an agriculture that, to the contrary of frequent statements, was utterly independent and unhampered by old notions. The land widened, the valleys were endless, the soil was so rich that fertilizers did not enter into consideration and for the most part have not yet. The wide prairies of Illinois and her sister States were reached. The disposition grew to produce more largely. The reaper came, and at once the mower. The hoe departed, and then the single plow for cultivation. The hay-rake was born, and the peripatetic threshing-machine. And then the steam or horse power corn-sheller. Coeval with these were a hundred preliminary devices such as drills, seeders, droppers, planters, harrows, cultivators. They were all successful. One supplanted another as experience grew. They all "paid" both the maker and the user. They came precisely in time. The millions of the cities who did not produce must be fed, and those cities were beginning to count their populations by hundreds of thousands. When a new region became accessible by the building of another railroad, the pioneering lasted only some three or five years, and then the question was not how to raise enough to live upon, but how to grow to feed, to ship, to turn into money, and with the money to buy more land. The aggregate result of this process is represented by the wealth of the United States to-day. More enormously profitable than all the gold-mines that were ever discovered is the present annual trade between States and sections in this country, and it is entirely the result of an experimental, but an always successful agriculture, where rules and traditions have all been disregarded, where the theories of the race have had no place, and where, for the most part, every man may be said to have learned for himself.

The farming area has been largely shifted to the West. These were prairie lands. Timber, for houses, fences and fuel did not and do not exist. The people who knew most about these regions united in declaring them unintended and unfit for human occupancy, beginning in the first place with northern Indiana and Illinois, and continuing the declaration as fitting Nebraska and Kansas with even more emphasis. But not only has the farmer occupied these regions, but he does it at a saving as against timber-lands, and with profit and convenience instead of failure. He burns coal, he builds his house of imported pine lumber, and he has fenced millions of acres with barbed wire, which in its turn is supplanted by Osage orange hedge.

Yet the day has come when the science of farming will be duly studied. Having practically accomplished the results noted, the son of this inventive experimenter turns back to find out why his father succeeded and to himself be still more successful. There is an agricultural college in every Western State, where the science of agriculture is actually taught, and these

institutions are at first entirely, and afterwards partially, supported by the State. It is worthy of note that some of the most valuable facts of agricultural chemistry, and of industrial entomology, have been made by the teachers and students of these colleges. The results aimed at are so eminently practical, and the lessons are taken from facts so near at hand, that, as might be expected from the entire history of American agriculture, tradition is almost entirely ignored. In the miracle of American progress no new thing is doubted until it is tried, since in this lies the secret of the miracle.

Nor is the Department of Agriculture a political bureau like some of its congeners in other countries. The publications of this department are of enormous general value, found upon the shelves of many humble farmers, and accessible in every library. The fact is fully realized that the time has almost come when every available acre of the public domain that does not require irrigation will be in the hands of a private owner. The section will be reduced to the quarter, and then the quarter to its forty. "Ten acres enough" is as finally applicable as a maxim here as it was ever anywhere. As farming lands grow more valuable more must be made of them for the individual holder. He must learn finally to substitute quality and mode for quantity. The cities grow; the millions increase; all must eat.

An endeavor has been made in this article to give some idea of old modes in crowded countries, and some of the new. It is manifest that a whole volume could be readily occupied by an article on agriculture, even by an article on American Agriculture alone. Much has been said upon the subject of drainage, as an instance in point, though in the State of Illinois alone probably every practical farmer knows from his own experience more than the article will tell him of the conditions which are imperative to him and to his locality. This is largely true of every branch of the subject that can be touched upon, and a discussion of general facts is alone possible. It is certain, finally, that every emergency that can arise will be met by those immediately interested, since that is the lesson of the entire story of American agriculture. Probably at this date the most powerful of all the empires the world has known, there is a general realization of the fact that the power of the United States lies really and finally in her soil.

AGRIGENTUM, in *Ancient Geography*, a city on the south coast of Sicily, part of the site of which is now occupied by a town called *Girgenti*, from the old name. (See GIRGENTI.) It was founded by a colony from Gela, 582 B.C. An advantageous situation, a free government, and an active commercial spirit raised the city to a degree of wealth and importance unknown to the other Greek settlements, Syracuse alone excepted. The prosperity of Agrigentum was interrupted by the usurpation of Phalaris, which lasted about fifteen years. He met with the common fate of tyrants, and after his death the Agrigentines enjoyed their liberty for sixty years; at the expiration of which term Theron usurped the sovereign authority. The moderation, justice, and valor of this prince preserved him from opposition. He joined his son-in-law Gelon, king of Syracuse, in a victorious war against the Carthaginians. Soon after his decease, 472 B.C., his son Thrasydeus was deprived of the diadem, and Agrigentum restored to her old democratical government, which she retained till the Carthaginian invasion in 406 B.C. During this interval of prosperity was executed most of those splendid public works which excited the admiration of succeeding ages, and caused Empedocles to remark "that the Agrigen-

tines built their dwellings as though they were to live forever, and indulged in luxury as if they were to die on the morrow." The total number of the inhabitants at this period was estimated by Diodorus at 200,000. The power of the Agrigentines now experienced a terrible reverse. They were attacked by the Carthaginians in 406 B.C., their armies routed, their city taken, and their race almost extirpated, scarcely a vestige of their material greatness being left. Although some of the fugitive inhabitants availed themselves of permission to return to the ruined city, and after a few years were even able to shake off the yoke of Carthage, Agrigentum never fully recovered from this fatal disaster. Such was the condition of the city 340 B.C. that Timoleon after his triumph over the Carthaginians, found it necessary to recolonize it with citizens from Velia in Italy. During the first Punic war Agrigentum was the headquarters of the Carthaginians, and was besieged by the Roman consuls, who, after eight months' blockade, took it by storm. It nevertheless changed masters several times during the contest, and in every instance suffered most cruel outrages. At the close of the war Agrigentum finally fell under the dominion of Rome.

The profuse luxury and display for which the Agrigentines are celebrated in history were supported by a fertile territory and an extensive commerce, by means of which the commonwealth was able to resist many shocks of adversity. It was, however, crushed in the fall of the Eastern Empire, and the Saracens obtained possession of the city.

Agrigentum occupied a hill rising between the small rivers Agragas and Hypsas, and was remarkable for its strength as a fortress. The whole space comprehended within the walls of the ancient city abounds with traces of antiquity. Of its many celebrated edifices, the most magnificent was the temple of Olympian Jupiter. Of this vast structure nothing remains except the basement and a few fragments of the columns and entablature; but these and many other monuments attest the ancient magnificence of the Agrigentines.

AGRIONIA, festivals celebrated annually by the Bœotians in honor of Dionysus, in which the women after playfully pretending for some time to search for that god, desisted, saying that he had hidden himself among the Muses. They were solemnized at night by women and the priests only. The tradition is that the daughters of Minyas, having despised the rites of the god, were seized with frenzy and ate the flesh of one of their children, and that the Agrionia were celebrated in expiation of the offense.

AGRIPPA, HEROD, the son of Aristobulus and Berenice, and grandson of Herod the Great, was born about 11 B.C. Josephus informs us that, after the death of his father, Herod, his grandfather, sent him to Rome to the court of Tiberius. The emperor conceived a great affection for Agrippa, and placed him near his son Drusus, whose favor he very soon won, as well as that of the empress Antonia. On the death of Drusus, Agrippa, who had been recklessly extravagant, was obliged to leave Rome, overwhelmed with debt, and retired to the castle of Malatha. After a brief seclusion, Herod the tetrarch, his uncle, who had married Herodias, his sister, made him principal magistrate of Tiberias, and presented him with a large sum of money; but his uncle grudging to continue his support, and reproaching him with his bad economy, Agrippa left Judeah, and soon after returned to Rome. There he was received with favor by Tiberius, and commanded to attend Tiberius Nero, the son of Drusus. Agrippa, however, chose rather to attach himself to Caius, who at that time was universally beloved, and so far won upon this prince that he kept him continually

about him. Agrippa being one day overheard by Eutyches, a slave whom he had made free, to express his wishes for Tiberius' death and the advancement of Caius, was betrayed to the emperor and cast into prison. Tiberius soon after died, and Caius Caligula ascended the throne 37 A.D. The new emperor heaped wealth and favors upon Agrippa, changed his iron fetters into a chain of gold, set a royal diadem upon his head, and gave him the tetrarchy of Batanæa and Trachonitis, which Philip, the son of Herod the Great, had formerly possessed. To this he added that held by Lysanias; and Agrippa returned very soon into Judea to take possession of his new kingdom. On the assassination of Coligula, Agrippa, who was then at Rome, contributed much by his advice to maintain Claudius in possession of the imperial dignity, to which he had been advanced by the army; and while he made a show of being in the interest of the senate, he secretly advised Claudius to maintain his position with firmness. The emperor, as an acknowledgment of his services, gave him the government of Judea; and the kingdom of Chalsis, at his request, was given to his brother Herod. Thus Agrippa became of a sudden one of the greatest princes of the East, the territory he possessed equaling in extent that held by Herod the Great, his grandfather. He returned to Judea, and governed it to the great satisfaction of the Jews. But the desire of pleasing them, and a mistaken zeal for their religion, impelled him to acts of cruelty, the memory of which is preserved in Scripture (Acts xii. 1, 2, etc.). About the feast of the Passover, 44 A.D., James the elder, the son of Zebedee and brother of John the evangelist, was seized by his order and put to death. He proceeded also to lay hands on Peter, and imprisoned him, delaying his execution till the close of the festival. But God having miraculously delivered Peter from prison, the designs of Agrippa were frustrated. After the Passover, he went into Jerusalem to Cæsarea, where he had games performed in honor of Claudius, and the inhabitants of Tyre and Sidon waited on him to sue for peace. Agrippa having come early in the morning to the theater to give them audience, seated himself on his throne, dressed in a robe of silver tissue, which reflected the rays of the rising sun with such a cluster as to dazzle the eyes of the spectators. When the king had delivered his address, the parasites around him shouted out that it was not the voice of a man but of a god. The vain Agrippa received the impious flattery with complacent satisfaction; but in the midst of his elation, looking upward with superstitious alarm, an owl perched over his head. During his confinement by Tiberius he had been startled by a like omen, which had been interpreted as portending his speedy release, with the warning that whenever he should behold the same sight again, his death was to follow within the space of five days. Seized with terror, he was immediately smitten with disease, and after a few days of excruciating torment, died, according to the Scripture expression, "eaten of worms," 44 A.D.

AGRIPPA, HEROD II., son of the preceding, born about 27 A.D., was made king of Chalcis on the death of his uncle Herod, 48 A.D. He died at Rome in the third year of Trajan, 100 A.D. He was the seventh and last of the family of Herod the Great. It was before him and Berenice, his sister, that St. Paul pleaded his cause at Cæsarea (Acts xxvi.).

AGRIPPA, MARCUS VIPSANIUS, according to Tacitus, was born of humble parents about 63 B.C. At the age of eighteen he was the chosen companion of Octavius (afterward Octavianus), the nephew and successor of Julius Cæsar, many of whose successes were mainly due to the courage and military talents of Agrippa. On the assassination of Cæsar, 44 B.C., Agrippa accompanied

his friend to Italy, and rendered essential service in the conduct of the first war against M. Antonius, which terminated in the capture of Perugia in 40 B.C. Three years after this Agrippa was made consul, and had the command in Gaul, where he defeated the Aquitani, and led the Roman eagles beyond the Rhine to punish the aggressions of the Germans on his province. But Agrippa was soon summoned to Italy by the critical state of the affairs of Octavianus, the whole coast being commanded by the superior fleets of Sex Pompeius. His first care was the formation of a secure harbor for the ships of Octavianus, and this he accomplished by uniting the Lucrine Lake with the sea. He made an inner haven also by joining the lake Avernus to the Lucrine. In these secure ports the fleet was equipped, and 20,000 manumitted slaves were sedulously trained in rowing and naval manœuvres until they were able to cope with the seamen of Pompeius. Agrippa was thus enabled in the following year to defeat Pompeius in the naval action of Mylæ; and soon after won a more signal victory near Naulochus. These victories gave Octavianus the empire of the Mediterranean, and secured to him Sicily, the granary of Rome, after an easy triumph over his feeble colleague Lepidus; and they prepared the way for the overthrow of the power of M. Antonius, the other triumvir. The merit of all these successes was very much due to the skill, resolution, and sagacity of Agrippa.

Agrippa was chosen ædile 33 B.C., and signalized his tenure of office by great improvements in the city of Rome, in the repair and construction of aqueducts and fountains neglected or injured during the civil wars, and in the enlargement and repair of the sewers. He appears also to have introduced an effectual mode of flushing the sewers by conducting into them the united waters of several different streams. From these useful labors Agrippa was again called away in 31 B.C. to command the Roman fleet, which, by the victory at Actium, fixed the empire of the world on Octavianus. The services of Agrippa made him a special favorite with Octavianus, who gave him his niece Marcella in marriage, 27 B.C., when he was consul for the third time. In the following year the servile senate bestowed on Octavianus the imperial title of AUGUSTUS. Agrippa, in commemoration of the naval victory of Actium, dedicated to Jupiter and all the other gods the Pantheon, now called *La Rotonda*. The inscription on its portico still remains, M. AGRIPPA L. F. COS. TERTIUM FECIT. In 25 B.C. we find this eminent man employed in Spain, where he reduced the insurgent Cantabri, the ancestors of the present Biscayans.

The friendship of Augustus and Agrippa seems to have been clouded by the jealousy of Marcellus, which was probably fomented by the intrigues of Livia, the second wife of Augustus, in dread of his influence with her husband. The consequence was that Agrippa left Rome; and though, to cloak his retirement, he was appointed proconsul of India, he went no farther than Mytilene. Marcellus dying within a year, Agrippa was recalled to Rome, and being divorced from Marcella, became the husband of the widowed Julia, who was no less distinguished by her beauty and abilities than afterward by her shameless profligacy.

In 19 B.C. Agrippa again led an army into Spain, where he subdued the Cantabri, who had been for two years in insurrection against the Romans. While in Gaul, where he also pacified the insurgent inhabitants, he constructed four great public roads, and the splendid aqueduct at Nemausus (now Nîmes), the ruins of which even yet excite admiration. On his return to Rome, 18 B.C., he was invested with the tribunician power, along with the emperor, for five years. After that

he was a second time made governor of Syria, 17 B.C., where, by his just and wise administration, he obtained general commendation, especially from the Hebrew population of his province, of which Judea formed a part. This resulted from his having, at the request of Herod the Great, gone up to Jerusalem, and granted special privileges for their religious worship to the Jewish subjects of the empire. In this journey, too, he colonized Berytus (now Beyrout) as a military and commercial settlement.

The last military employment of Agrippa was in Pan-
nonia, 13 B.C., where his character for equity was of itself sufficient to put down insurrection without bloodshed. Returning to Italy, he lived there in retirement, greatly honored, and died at Campania, 12 B.C., two years before his imperial father-in-law. He was the greatest military commander of Rome since the days of Julius Cæsar, and the most honest of Roman governors in any province.

Under the care of Agrippa, Julius Cæsar's design of having a complete survey of the empire made was carried out. He had a chart of the entire empire drawn up, and projected a great work on the geography of its provinces. His materials were placed in the public archives, where Pliny consulted them (Nat. Hist., iii.). Agrippa also wrote an account, now lost, of the transactions in which he had taken part.

Agrippa left several children: by his first wife he had Pomonia Vipsania, who became the first wife of Tiberius, and was the mother of Drusus; and by Julia he was the father of Caius and Lucius Cæsar, who were adopted by Augustus; of Julia, married to Lepidus; of Agrippina the elder; and of Agrippa Posthumus. (See Dio Cassius; Appianus; Suetonius; Velleius Paterculus; Ferguson's *Rom. Rep.*; Merivale's *Romans under the Empire.*)

AGRIPPA, HENRY CORNELIUS (VON NETTESHEIM), knight, doctor, and by common reputation a magician, was born of a noble family at Cologne on September 14, 1486. Educated at the University of Cologne, he entered when still very young into the service of the Emperor Maximilian, who sent him on a diplomatic mission to Paris in 1506. During the next three years he was engaged in a military expedition to Catalonia, and then in the formation of a secret society of theosophists, the first of those alternations between the career of the knight and the career of the student in which his whole life was passed. In 1509 he went by invitation to the University of Dôle in Burgundy, and read lectures on Reuchlin's *De Verbo Mirifico*, which gained for him the degree of doctor of divinity and a stipend. It was these lectures that first stirred against him that malignant hatred of the monks which embittered his life and blackened his memory. He was denounced as an impious and heretical cabalist by an obscure monk named Catilinet, in lectures delivered at Ghent (1510) before Margaret of Burgundy, and his hopes of securing the patronage of that princess were thus for the time disappointed. To win her favor he had composed (1509) and dedicated to her a treatise, *De Nobilitate et Præcellentia Fæminæ Sexus*, the publication of which was delayed from motives of prudence until 1532. For the same reason the same course was followed in regard to his treatise *De Occulta Philosophia*, which, though completed in the spring of 1510, did not appear until 1531. In writing it he had the advice and assistance of the abbot Trithemius of Würzburg. Failing to receive encouragement as a man of letters, Agrippa was forced again to enter the diplomatic service. In 1510 the emperor sent him on a mission to London, where he became the guest of Dean Colet at Stepney. Soon after his return home he was

summoned to follow his imperial master to the war in Italy, where he won his spurs—probably at the battle of Ravenna. In the autumn of 1511, on the invitation of the Cardinal de Santa Croce, he attended the schismatic council of Pisa as theologian, and by so doing still further provoked the hostility of the papal party. After a period spent in the service of the Marquis of Montferrat, during which he visited Switzerland, Agrippa was invited in 1515 to the University of Pavia, where he delivered lectures on the *Pimander* of Hermes Trismegistus, the first of which is preserved among his published works, and received a doctor's degree in law and medicine. He was still doomed, however, to a harassed, unsettled life. Three years were spent in the service of the Marquis of Montferrat and the Duke of Savoy. In 1518 he became syndic at Metz, where he was involved in disputes with the monks, and especially with the inquisitor Nicolas Savin, before whom he boldly and persistently defended a woman accused of witchcraft. He was, chiefly in consequence of this, compelled to resign his office, and quitted Metz for Cologne in January, 1520. After two years spent in seclusion in his native city, he went to Geneva, where he practiced medicine for a short time.

In 1523 he removed to Friburg, having been appointed town physician. In the following year he was induced to go to Lyons as court physician to the queen-mother, Louisa of Savoy, but the change did not better his condition, since, though he received several empty honors, his salary remained unpaid. It was probably amid the privations of poverty that he composed in 1526, his *De Incertitudine et Vanitate Scientiarum et Artium atque Excellentia Verbi Dei Declamatio*, which was first published in 1530. The work is remarkable for the keenness of its satire on the existing state of science and the pretensions of the learned, and when published furnished fresh occasion for the malicious misrepresentation of his enemies. A quarrel with the queen compelled Agrippa to leave Lyons and betake himself to the Netherlands. In 1529 he was appointed historiographer to the Emperor Charles V., and in that capacity wrote a history of the emperor's reign. The salary attached to the office was, however, left unpaid, and Agrippa was consequently imprisoned at Brussels, and afterward banished from Cologne, for debt. He died at Grenoble in 1535.

The character of Agrippa has been very variously represented. The earlier accounts are grossly disfigured by the calumnies of the Dominicans, whose hatred, following him even to the grave, placed over it an inscription that is probably unique in its spiteful malignity. In later times full justice has been done to his memory. A Life of Agrippa by Henry Morley (London, 1856) contains a detailed analysis of his more important works. A complete edition of his writings appeared in two volumes at Leyden in 1550, and has been several times republished.

AGRIPPINA (THE ELDER), the virtuous and heroic but unfortunate offspring of M. Agrippa by a very abandoned mother, and herself the parent of a still more profligate and guilty daughter of the same name. She was early married to Germanicus, the son of Drusus and Antonia, the niece of Augustus. On the death of Augustus she joined her husband in his German campaigns, where she had several opportunities of showing her intrepidity, sharing with Germanicus his toils and his triumphs. The love which the army showed for this leader was the cause of his recall from the Rhine by the suspicious Tiberius. He was soon afterward sent into Syria, where he died at Antioch from the effects, it was believed, of poison administered to him by Piso, the governor of Syria.

On his deathbed Germanicus implored his wife, for the sake of their numerous children, to submit with resignation to the evil times on which they were fallen, and not to provoke the vengeance of the tyrant Tiberius. But, unhappily, this prudent advice was not followed by the high-spirited woman, who, on landing at Brundisium, went straight to Rome, entered the city bearing the urn of her deceased husband in her arms, and was received amid the tears of the citizens and the soldiery, to whom Germanicus was dear. She boldly accused Piso of the murder of her husband, and he, to avoid public infamy, committed suicide. She continued to reside at Rome, watched and suspected by Tiberius, who for some time dreaded to glut his vengeance on the widow and family of so popular a prince as Germanicus. She soon had the temerity to upbraid the tyrant with his hypocrisy in pretending to worship at the tomb of Augustus. He began by putting to death both men and women who had shown attachment to the family of Germanicus; and finally he arrested Agrippina and her two eldest sons, Nero and Drusus, and transported them to the isle of Pandataria, where her mother Julia had perished; and there she was starved, or starved herself, to death in the thirty-third year of our era. Tiberius also ordered the execution of her two eldest sons; yet it is remarkable that by his will the emperor left her youngest son Caius, better known by the name of *Caligula*, as one of the heirs of the empire.

AGRIPPINA, daughter of Germanicus and Agrippina the elder, sister of Caligula, and mother of Nero, was born about 15 A.D., at Oppidum Ubiorum, which was at that time the headquarters of her father's legions, and which was after her named *Colonia Agrippina Ubiorum* (now Cologne). She wrote memoirs of her times, which Tacitus quotes and Pliny commends; but her life is notorious for intrigue and perfidy. In 28 A.D. she became the wife of Cn. Dom. Ahenobarbus, who died in 40 A.D. Her next husband was Crispus Passienus, whom some years afterward she was accused of poisoning. For flagitious conduct, Caligula banished her to the isle of Pontia; but on the accession of her uncle Claudius, 41 A.D., she was set free, and began to succeed in her ambitious schemes. After Messalina had been put to death, 48 A.D., Agrippina was raised by Claudius to her place as his imperial consort, 49 A.D. She prevailed upon him to discard Britannicus, his own son, and to adopt her son Domitius in his stead. She removed from her path all whom she feared or envied, and in 54 A.D. poisoned Claudius at Sinuessa that she might reign as regent for her son. Nero in a short time grew tired of her interference, and when she first intrigued against and then frowned upon him, he ordered her to be slain at her villa on the Lucrine lake. After having been slightly wounded by Anicetus, she perished by the sword of a centurion, 60 A.D.

AGROTERAS THUSIA, an annual festival at Athens in honor of Artemis or Diana, in fulfillment of a vow made by the city before the battle of Marathon to offer in sacrifice a number of goats equal to that of the Persians slain in the conflict. The number was afterward restricted to 500.

AGTELEK, a village of Hungary, in the county of Gömör, near the road from Pest to Kaschau. In the neighborhood is the celebrated stalactite grotto of Baradla, one of the most remarkable in Europe. The entrance is extremely narrow, but the interior spreads out into a labyrinth of caverns, the largest of which, called the Flower Garden, is ninety-six feet high and ninety feet wide, and extends nearly 900 feet in a straight line. In these caverns there are numerous stalactite structures, which, from their curious and fantastic shapes, have re-

ceived such names as the Image of the Virgin, the Mosaic Altar, etc.

AGUA, VOLCANO DE, a huge mountain in Central America, twenty-five miles southwest of Guatemala. It is of a conical shape, and rises to a height of 15,000 feet above the level of the sea. At the summit there is a crater, measuring about 140 yards by 120, from which stones and torrents of boiling water are occasionally discharged. In close proximity to Agua are the volcanoes of Pacaya, on the southeast, and Fuego on the west, and the three present together a scene of great magnificence.

AGUADO, ALEXANDER MARIA, one of the most famous bankers of modern times, was born of Jewish parentage in Spain in 1784. He commenced life as a soldier, fighting with distinction in the Spanish war of independence on the side of Joseph. After the battle of Baylen (1808) he entered the French army, in which he had risen to be colonel and aide-de-camp to Marshal Soult, when he took his discharge in 1815. He immediately commenced business as a commission-agent in Paris, and chiefly through his connection with Spain and the Spanish colonies, acquired in a few years wealth enough to enable him to undertake banking. The Spanish government gave him full powers to negotiate the loans of 1823, 1828, 1830, and 1831; and Ferdinand VII. rewarded him with the title of Marquis de las Marismas del Guadalquivir, and the decorations of several orders. Aguado also negotiated the Greek loan of 1834. In 1828, having become possessed of large estates in France, including the Chateau Marguax, famous for its wine, he was naturalized as a French citizen. He died in 1842, leaving a fortune computed at 60,000,000 francs.

AGÜAS CALIENTES, a town in Mexico, capital of the state of the same name, situated 270 miles northwest of the city of Mexico, in 20° N. lat., and 101° 45' W. long. It takes its name from the hot springs in its vicinity. The climate is fine, and the extensive and beautiful gardens surrounding the town produce an abundance of olives, figs, grapes, and pears. It has a large manufactory of woolen cloth, and the general trade is considerable. Population, 40,000.

AGUE (*Febris Intermittens*) is the common name for an intermittent fever accompanied by paroxysms or fits. Each fit is composed of three stages—the cold, the hot, and the sweating stage. Before a fit the patient has a sensation of debility and distress about the epigastrium; feels weak and disinclined for exertion; the surface of his body becomes cold and the bloodless skin shrivels up into the condition termed goose-skin (*cutis anserina*). A cold sensation creeps up the back, and spreads over the body; the patient shivers, his teeth chatter, his knees knock together; his face, ears, lips, and nails turn blue; he has pains in his head, back, and loins. This condition is succeeded by flushes of heat, the coldness gives place to warmth, and the surface regains its natural appearance. The warmth continues to increase, the face becomes red and turgid, the head aches, the breathing is deep and oppressed, the pulse full and strong. The third stage now comes on, the skin becomes soft and moist, the pulse resumes its natural force and frequency, and a copious sweat breaks over the whole body.

These paroxysms recur at regular intervals. The interval between them is called "an intermission." When they occur every day the patient has quotidian ague; every second day, tertian; and when they are absent for two days, quartan. There is a double quotidian in which two paroxysms occur daily; in the double tertian there is a daily attack; but the paroxysms of successive days differ in some respects, while those of alternate days agree in character. Quintan, sextan, heptan, and

oetan cases are extremely rare. All ages are liable to the disease.

The exciting causes of this disease are unknown, but are thought by some to be effluvia from the surface of the earth (marsh miasmata). Others again believe that a bacillus of some kind causes the disorder. A certain degree of temperature—higher than 60°F.—seems necessary for the production of the poison. It does not exist within the Arctic circle, nor does it appear in the cold seasons of temperate climates and seldom beyond 50° of N. lat. It also requires moisture.

The treatment of ague must be considered under two heads—during the paroxysm and in the “interval.” It is carried out generally as follows: As ague is a specific disease, little can be done during the paroxysm, save by applying external warmth to the body during the cold stage, and by administering restoratives should collapse occur at the end of the hot stage. During the interval, after purgatives have been administered, quinine must be given with the object of breaking the recurrence of the paroxysm, and thus, if possible, preventing grave degeneration of the organs and malarial cachexia. Arsenic is sometimes used to attain this object. The Pontine Marshes of the south of Rome have long been notorious as a source of agueish fevers. Peat bog, or moss, is not productive of malaria, as is seen in parts of Ireland and Scotland. Neither is ague ever seen among the inhabitants of the Dismal Swamp.

AGUESSEAU, D', HENRI FRANCOIS (written by himself DAGUESSEAU), a celebrated French chancellor, orator, and legislator, was born at Limoges, November 27, 1668. He passes for the most learned lawyer that France ever produced, and is called the father of French forensic eloquence. In 1691 he was appointed by Louis XIV. one of the advocates-royal. He became procureur-général to the Parliament in 1700, and chancellor of France in 1717. Before the latter date he had resolutely defended the liberties of the Gallican Church against the aggressions of the papal power in the case of the bull *Unigenitus* (1713). He was banished from court in 1718 for his opposition to the financial system of Law, but was restored to his high functions in 1720, after the ruinous collapse of that system. A contest for precedence between D'Aguesseau and Cardinal Dubois resulted in the removal of the former from office in 1722. He was again appointed chancellor in 1737, and kept the seals until 1750, when he resigned on account of his great age. He died in Paris in February, 1751. His works, consisting chiefly of forensic arguments, official papers, and treatises on law, were published in thirteen volumes (1759-89). His legislative reforms constitute perhaps his greatest claim to the remembrance of posterity.

AGUESSEAU, D', HENRI C. JEAN BAPTISTE, COUNT, born at Fresnes in 1746, was a grandson of the chancellor. He became a member of the French Academy in 1789, and a senator in 1805. He died in 1826.

AGUIAR, TOMAS, a Spanish portrait-painter of the seventeenth century.

AGUILA, C. F. E. H., an officer of engineers, who traveled extensively between 1770 and 1774. He appears to have been a native of Spain. He wrote, in French, a “History of the Reign of Gustavus III. of Sweden” (1803), and died in 1815.

AGUILA, DEL, MIGUEL, a Spanish painter, whose works are held to be in the style of Murillo. He died at Seville in 1736.

AGUILAR, GRACE (1816-47), an admired English authoress, was the daughter of a Jewish merchant in London. Her works, written in a pleasing, elegant, and impressive style, consist chiefly of religious fictions, such as *The Martyr* and *Home Influence*. She also

wrote in defense of her faith and its professors, *The Spirit of Judaism*, and other works. After a long struggle with increasing bodily infirmities, she died at Frankfurt, on her way to Schwalbach, in the autumn of 1847.

AGUINALDO, EMELIO, a leader of the Philippine insurgents of 1896, and their commander-in-chief in the Spanish-American War of 1898. Was born of Chinese and Tagalog parentage in the town of Imus, province of Cavite, Island of Luzon, in the year 1870. He was educated at the College of St. Jean de Lateran and the University of St. Thomas in Manila. Later he studied medicine for a short time at the Pontifical University, as the protégé of a Jesuit priest of that institution. Owing to some trouble with the authorities, he left for Hong Kong, in which city he became interested in military affairs and acquired some knowledge of warfare. He also easily learned to speak English, French, and Chinese. His education, natural ability, shrewdness, and diplomacy, combined with a rare personal magnetism, were recognized by his countrymen and at the outbreak of the rebellion against Spanish authority in 1896 he led the insurgents and later became commander-in-chief during the Spanish-American War. While in Hong Kong he headed a party which succeeded in securing a large sum of money from the Spanish government to the Philippine leaders to lay down their arms. A quarrel among his associates over this money caused him to go to Singapore, where he met the United States consul just prior to the war between the United States and Spain. On representations from the consul, Admiral Dewey telegraphed to have Aguinaldo sent to him, and he arrived at Cavite just shortly after the battle of Manila Bay. He was given an opportunity to organize against Spanish authority, but no promises were made to him nor were the insurgents ever officially recognized by the Americans. A serious outbreak occurred when the Americans refused to recognize the right of the Filipinos to sack the city of Manila after its capture.

On June 12, 1898, Aguinaldo organized a so-called Filipino Republic, with himself as president, but soon thereafter declared himself dictator. Still bitterly opposing the Spanish-American treaty of peace, which ceded the Philippine Islands to the United States, he declared the independence of the Islands, ordered a wholesale slaughter of all Americans and Europeans on the Islands. His conspiracy was discovered in time to prevent its being carried to completion. He continued undaunted, however, in his opposition to the occupation of the Islands by Americans, and on the evening of February 4, 1899, severely attacked the American line in the suburbs of Manila. This was an instant signal for the ratification of the Spanish-American treaty by the United States Senate. Early in 1900 the insurrection, which had been confined to the Tagalog nationality chiefly, was broken up and Aguinaldo was forced into hiding. On March 23, 1901, he was captured by General Frederick Funston of the United States Army.

AHAB, king of Israel, was the son and successor of Omri. He ascended the throne in the thirty-eighth year of Asa, king of Judah, *i. e.*, 918 B.C., and reigned over Samaria twenty-two years. Having married Jezebel, daughter of Ethbaal, king of the Sidonians, he was brought into closer connections with the neighboring towns in the north, and strengthened himself considerably, so that he was able to consolidate the disunited kingdom, and render it powerful against Judah. Some notices out of Menander, preserved by Josephus, lead to the conclusion that Ethbaal, father of Jezebel, was identical with Ithobal, priest of Astarte, who usurped the throne of Tyre after murdering Phœles the king. It is not improbable that Ahab's marriage with such a princess was the means of procuring him great riches, which brought pomp and luxury in their train, along with the material and social influences that give a certain security to

monarchy. We read of his building an ivory palace and founding new cities, the effect perhaps of a share in the flourishing commerce of Phœnicia. But his matrimonial connection with Tyre and Sidon, however fruitful in wealth, was in many respects detrimental. His wife was a strong-minded, passionate devotee of idolatry, who exercised an injurious influence over him. Led by her, he gave a great impulse to the worship of Baal and Astarte in his kingdom. For the former he built a temple with an altar; of the latter he made that well-known image which existed long after. Under the patronage of Jezebel, the Phœnician cultus assumed important dimensions, for Baal is said to have had 450, Astarte 400 priests and prophets. The infatuated queen was especially hostile to the prophets and priests of Jehova, whom she tried to exterminate; but the former in particular, though sore pressed, were not entirely cut off. They still held their ground; and Elijah, the most conspicuous of them, came off victor in the contest with Baal's ministers. Jehovism triumphed in the person of the intrepid Tishbite, whom the queen was unable to get into her power. Ahab was a public-spirited, courageous monarch. He defeated the Syrians twice, and concluded a peace with Benhadad on favorable terms. Metha, king of Moab, paid him a large yearly tribute. In conjunction with Jehoshaphat, king of Judah, he went forth to battle a third time against the Syrians, and was slain at Ramoth-Gilead. It speaks favorably for his disposition that he repented of the cruel measures taken against Naboth, and that he humbled himself before the Lord. Though he feared Elijah and Micaiah, he was not insensible to their utterances; nor could he have suffered so many as 400 prophets to live in his kingdom without some little regard for their office. The prophetic voice, held as it was in small esteem, must have had some influence upon his administration, especially when political grounds coincided with it. His evil courses were due much more to the influence of Jezebel than to his own vicious impulses.

As the accounts of Ahab are fragmentary, it is not always easy to make out from them a clear or connected history of his reign. There is room for conjecture and misconception. Thus Ewald represents him as building a splendid temple, with an oracle-grove of Astarte near his favorite palace at Jezreel, on the basis of 1 Kings xvi. 32, xviii. 19; but this is imaginary, since the original does not speak of a *grove* but of *Astarte* (xviii. 19); nor is it probable that a second structure of the kind mentioned existed elsewhere in addition to Baal's temple in Samaria. Neither can it be held as likely that a large statue of Baal was set up in front of his temple, and small statues of him in the interior, merely because we read in 2 Kings x. 26, 27, first of bringing forth the *images* of Baal, and then of breaking the *image* of the same sun-god. Rather were the smaller images in the porch and the chief one in the interior, so that the reading or punctuation of verse 26 should be slightly altered. Whether the 450 or 400 prophets were distinct from the priests is doubtful. Identifying them, we believe that the priests acted as prophets, procuring for themselves greater renown among the ignorant people by their arts of necromancy and magic.

For the biography of this monarch we are indebted almost exclusively to the books of Kings, where the writers consider him in a theocratic rather than a political aspect. Viewing him from their later prophetic standpoint, their portrait is somewhat one-sided, though correct in the main. It is observable that the portions of the Kings in which he is spoken of are somewhat different in character and expression, betraying the use of different sources by the compiler. 1 Kings xvi. 29-33, xxii. 39, 2 Kings x. 25-28, are more historical than the

rest, which contain almost all that is related of Ahab, and were derived from tradition. It has been conjectured by Hitzig that the 45th psalm owes its origin to Ahab, being the joyous poetical expression of a matrimonial connection with Tyre, which augured unusual prosperity for the distracted kingdom. But the assumption is improbable, because, as De Wette observes, an event belonging to Ephraim was hardly a fitting subject included in the canon.

Another Ahab, a false prophet in the time of the Babylonian exile, is mentioned by Jeremiah (xxix. 21), and threatened with terrible punishment.

AHALA, a noble Roman family of the gens Servilia, which produced many distinguished men. Of these the most celebrated is C. Servilius Structus Ahala, master of the horse to the dictator Cincinnatus, B.C. 439. He signalled himself by his boldness in slaying in the forum with his own hand the popular agitator Sp. Mælius, for refusing to appear before the dictator on a charge of conspiracy against the state. For this act Ahala was brought to trial. He saved himself from condemnation by retiring into exile.

AHIANTA, a territory on the Gold Coast of Africa, lying on the second parallel of W. long. It is one of the richest and most fertile districts in that part of the continent. Axim, the chief settlement, was founded by the Dutch, but now belongs to Britain.

AHASUERUS, the Latinised form of the Hebrew *Ahashverosh*, אֲחַשְׁוֵרֶשׁ (in the LXX. Ἀδούρηρος once in Tobit Ἀδύρηρος), occurs as a royal Persian or Median name in three of the books of the canonical Scriptures, and in one of the books of the Apocrypha. In every case the identification of the person thus named with those found in profane history is matter of controversy. The hypothesis of Fürst and others, that in all the passages one and the same person is meant, viz., the well-known Xerxes, may be set aside as quite inapplicable to the facts; and it becomes necessary to glance at the particular places.

In Dan. ix. 1, Ahasuerus appears as the father of Darius the Mede, who "was made king over the realm of the Chaldeans" after the conquest of Babylon and death of Belshazzar. Who this Darius was is one of the most difficult and disputed questions of ancient history. If, as is very generally supposed, he is Astyages, the grandfather of the great Cyrus, and the last independent king of Media, then Ahasuerus is to be identified with Cyaxares, the father of Astyages. The passage in Tobit where the name occurs (xiv. 15) lends confirmation to this view. It is there stated that Nineveh was captured and destroyed by "Nabuchodonosor and Assuerus." According to Herodotus (i. 106 cf. Rawlinson's *Her.*, vol. i. 412), it was the Medes under Cyaxares who took Nineveh.

In Ezra iv. 6 Ahasuerus is mentioned as a king of Persia, to whom the enemies of the Jews sent representations opposing the rebuilding of the temple at Jerusalem. Here the sequence of the reigns in the sacred writer and in the profane historians—in the one, Cyrus, Ahasuerus, Artaxerxes, Darius; in the other, Cyrus, Cambyses, Smerdis, Darius—leads naturally to the identification of Ahasuerus with Cambyses. Other circumstances, especially the known policy of the usurper Smerdis, and its reversal by Darius (see Inser. of Behistun, col. i § 14), corroborate this conclusion.

In the book of Esther, Ahasuerus is the name borne by that king of Persia, certain events of whose court and empire (which will be noticed elsewhere, see ESTHER) form the subject of the whole narrative. (Throughout this book the LXX. render the name Ἀραξέρξης.) The hypothesis of certain writers, that this Ahasuerus is the Cyaxares, king of Media, already

referred to, may be at once dismissed. That of others, identifying him with Artaxerxes Longimanus, the son and successor of Xerxes, though countenanced by Josephus, deserves scarcely more consideration. Recent inquirers are all but universally of opinion that he must be a monarch of the Achaemenian dynasty, earlier than this Artaxerxes; and opinion is divided between Darius Hystaspis and his son and successor Xerxes. In support of the former view it is alleged, among other things (see Tyrwhitt's *Esther and Ahasuerus*, p. 162), that Darius was the first Persian king of whom it could be said, as in Esther i. 1, that he "reigned from India even unto Ethiopia, over an hundred and seven and twenty provinces;" and that it was also the distinction of Darius that (Esther x. 1) he "laid a tribute upon the land and upon the isles of the sea" (cf. Herod. iii. 89). In support of the latter view it is alleged—(1.) That the Hebrew *Ahashverosh* is the natural equivalent of the old Persian *Khsayarsha*, the true name of the monarch called by the Greeks Xerxes, as now read in his inscriptions; (2.) That there is a striking similarity of character between the Xerxes of Herodotus and the Ahasuerus of Esther; (3.) That certain coincidences in dates and events corroborate this identity, as, e. g., "In the third year of his reign Ahasuerus gave a grand feast, to his nobles, lasting one hundred and eighty days (Esther i. 3); and Xerxes in his third year also assembled his chief officers to deliberate on the invasion of Greece (Herod. vii. 8). Again, Ahasuerus married Esther at Shushan in the seventh year of his reign; in the same year of his reign Xerxes returned to Susa with the mortification of his defeat, and sought to forget himself in pleasure. Lastly, the tribute imposed on the land and isles of the sea also accords with the state of his revenue, exhausted by his insane attempt against Greece" (Kitto's *Cyclo-pædia*, s.v. Ahasuerus). To this it may be added that the interval of four years between the divorce of Vashti and the marriage of Esther is well accounted for by the intervention of an important series of events fully occupying the monarch's thoughts, such as the invasion of Greece. It may be added that by the advocates of both views appeal is made, with more or less of confidence, to the names of the queens of the respective sovereigns; Atossa, wife of Darius, answering to Hadassah, and Amestris, wife of Xerxes, to Esther (Esther ii. 7); and also to the number of generations, indicated in the genealogy of Mordecai from the deportation of the Jews into Babylon (Esther ii. 5; cf. Tyrwhitt, p. 95, with Rawlinson, *Bampton Lect.*, p. 186). If, as seems probable, the name Ahasuerus is the transcription of the Persian *Khsayarsha* (written *Hisiarsa* in Babylonian) which, according to Sir H. Rawlinson, means "venerable king" (see Rawlinson's *Her.* iii. 363), then this name may be reasonably supposed to have been originally an appellative, and its application, especially by foreigners like the Jews, to different royal persons, is explained.

AHAZ (literally *Possessor*), son of Jotham, and the eleventh king of Judah, reigned 16 years, from 741 to 725 B.C. He was the most weak-minded and corrupt of all the kings that had hitherto reigned over Judah. About the time of his accession, Pekah, king of Israel, and Rezin, king of Syria, had formed an alliance with the view of acquiring the kingdom of Judah by conquest. They invaded the country, laid siege to Jerusalem, and carried away an immense number of captives, though they failed to secure their ultimate object. At the same time incursions were made by the Edomites and Philistines, and Ahaz was fain to call in the aid of Tiglath-Pileser, king of Assyria, who destroyed the power of Syria, but took care to exact heavy tribute for

the service thus rendered. Ahaz was even compelled to appear as a vassal at Damascus, and so to bring his kingdom to the lowest point of political degradation. In religion Ahaz was a heathen. He broke in pieces the vessels of the temple of God, and at last ventured to close its gates altogether. He sacrificed to Syrian deities, erected altars on which incense was to be offered, and caused his son to pass through the fire to Moloch. He was succeeded by his son Hezekiah. In the inscriptions of Tiglath-Pileser II., King of Assyria, *Yahukhazi Jahudai*, that is, Joahaz or Ahaz of Israel, appears among the names of those who acknowledged his sovereignty and paid tribute. (Schrader's *Die Keilinschriften und das Alte Testament*.)

AHAZIAH (lit. *Whom the Lord sustains*), son and successor of Ahab, and eighth king of Israel, reigned scarcely two years, from 897 to 866 B.C. He continued in the idolatrous practices of his father, worshipping Baal and Ashtoreh. Upon his accession the Moabites revolted, and refused any longer to pay the tribute which had been exacted from them since the establishment of Israel as a separate kingdom. Before Ahaziah could take measures to subdue them, he was seriously injured by a fall from the lattice of an upper chamber in his palace. He immediately sent messengers to the oracle of the god Baalzebub at Ekron, to inquire the issue of his illness. While on their way they were met by Elijah the prophet, who bade them return and tell the king that he would surely die.

AHAZIAH, son of Jehoram and Athaliah, daughter of Ahab, and sixth king of Judah, reigned one year, 885 B.C. Under the evil influence of his mother, he walked in the ways of Ahab's house, and was an idolatrous and wicked king. He was slain by Jehu, the son of Nimshi.

AHENOBARBUS, the name of a plebeian Roman family of the gens Domitia, which rose in the course of time to considerable distinction. The name was derived from the red beard and hair by which many of the family were distinguished. The emperor Nero was of this family.

AHITHOPHEL (lit. *Brother of Foolishness*, i. e. *foolish*), the very singular name of one of the sagest politicians in Old Testament history. He was one of David's most trusted counselors, and his defection to the cause of Absalom was a severe blow to the king, who prayed that God would bring his counsel to "foolishness," probably alluding to his name. Ahithophel's advice was at first acceptable to Absalom's party, and probably laid down the policy which alone was likely to be successful; but Hushai's counsel of delay, given in the secret interest of David, was ultimately adopted. Ahithophel's political foresight enabled him to see that this resolution would prove fatal to the rebel cause, and he at once returned to his home at Giloh, "put his household in order, and hanged himself." This is the only case of *deliberate* suicide that is mentioned in the Old Testament.

AHLQUIST, AUGUST, born in Finland, August 7, 1826; studied at Helsingfors and afterward became professor of the Finnish language there. He is a noted grammarian and lexicographer, and has published poems, books of travel and translations from the German.

AHMADABAD, a district and city of British India, in the province of Gujrat, within the jurisdiction of the governor of Bombay. The district lies between 21° 4' and 23° 5' N. lat., and between 71° 2' and 73° 25' E. long. It is bounded by the province of Kātiwār on the north and west, by the Mahi Kānta on the north and east, by the Kaira collectorate on the east and south, and by the gulf of Cambay on the south. The area of the district is 3,844 square miles. The river Sābarmati and

its tributaries, flowing from the north-east to south-west into the gulf of Cambay, are the principal streams that water the district. The north-eastern portion is slightly elevated, and dotted with low hills, which gradually sink into a vast plain, subject to inundation on its western extremity. With the exception of this latter portion, the soil is very fertile, and some parts of the district are beautifully wooded. The total population of Ahmadábád is returned at 856,324 souls, the average density, as compared with the area, being 216 to the square mile, and the proportion of females 891 to every 1000 males. About 86 per cent. of the population are returned as Hindus, 10 per cent. as Mahometans, and 4 as Buddhists. The percentage of persons of other denominations is infinitesimal, their total number being only 1237 souls.

The hamlets for the most part consist of substantial houses of bricks and tiles, with only a small portion of huts. Some of the larger villages contain houses with upper stories, and the general appearance of the inhabitants indicates prosperity. The principal agricultural products are rice, wheat, bajrá, and cotton, with a little sugar-cane, tobacco, and oil-seeds. Silk manufacture forms an important industry of the city. The total revenue of the district in 1871 amounted to £152,344, of which £147,283 was derived from the land; the total net expenditure on civil administration in the same year amounted to £21,700. The fiscal system consists for the most part of settlements direct with the husbandman, technically known as *rayatwári*; but some villages are "*tálukdári*," in which the "*tálukdár*" or landholder collects the revenue, and pays 70 per cent. of it to Government, retaining the remaining 30 per cent. for himself. The excise revenue is generally farmed out, but a government distillery exists in the city. The land settlement is fixed for a period of thirty years, and expired in different parts of the district between the years 1884 and 1888. Seventy-five per cent. of the total area of the district is cultivable, of which 55 per cent. is actually under cultivation, the other 20 per cent. remaining fallow. The principal marts in Ahmadábád are Dhollerá, Gogo, Dholká, and Viramgón. Municipalities have been established in the towns of Ahmadábád, Dholká, Mandú, Gogo, Dhandúka, Prántej, and Moráshá; the rate of the municipal taxation per head of population varies from 2s. 6½d. in Ahmadábád to 4¼d. in Moráshá, the average throughout the eight towns being 1s. 7½d. per head. The municipal income is chiefly derived from octroi duties, which in some of the towns are farmed. Thirteen towns are returned as containing a population exceeding 5000 souls, namely, Ahmadábád, population 116,873; Dholká, 20,854; Viramgón, 19,661; Dhollerá, 12,468; Dhandúka, 9782; Gogo, 9571; Prántej, 8341; Moráshá, 7436; Sanand, 7229; Mandú, 6774; Patrí, 6320; Barwála, 5813; and Ranpur, 5796. The district contains 145 schools, in eight of which English is taught. The police force numbers 1189 men. The Kolis contribute most largely to the criminal population.

AHMADÁBÁD CITY, the capital of the district, is situated on the east or left bank of the river Sábarmati, in 23° N. lat., and 72° 36' E. long. It was formerly one of the largest towns in India, celebrated for its commerce and manufactures of gold and silver, silk and cotton fabrics, articles of gold, silver, steel, enamel, mother of pearl, lacquered ware, and fine wood-work. Excellent paper was also manufactured, and a large trade carried on in indigo, cotton and opium. With the rise of the Marhattá power, however, Ahmadábád became the scene of repeated struggles between the Marhattás and the Mussulmans, whose power was then on the wane, and from this period its prosperity declined. It was captured by the Marhattás in 1755, and again by the British in 1780. The latter soon afterwards gave the town back

to the Marhattás, who held it till it finally came into the hands of the English in 1818. The present state of the city is flourishing. It contains a population of 127,621 souls, and is a large and important station on the Bombay, Baroda, and Central India Railway. It is the seat of important silk manufacturers, and has two cotton-mills worked by steam-power.

The principal objects of architectural interest are the Jain temple of Seth Hathisinh and the Juma Masjid or Great Mosque. The Jain temple is a modern edifice, having been erected about twenty-five years ago by Hathi Sinh, a rich Jain merchant, who dedicated it to Dharmnáth. This modern style shows that the Jain style of architecture has hardly degenerated from its ancient excellence. The external porch, between two circular towers, is of great magnificence, most elaborately ornamented, and leads to an outer court, with sixteen cells on either side. In the centre of this court is a domed porch of the usual form, with twenty pillars. The court leads to an inner porch of twenty-two pillars, two stories in height, with a roof of a shape very fashionable in modern Jain temples, though by no means remarkable for beauty. This inner porch conducts to a triple sanctuary. The exterior of the temple expresses the interior more completely than even a Gothic design; and whether looked at from its courts or from the outside, it possesses variety without confusion, and an appropriateness of every part to the purpose for which it was intended. The Juma Masjid or Great Mosque of Ahmadábád, although not remarkable for its size, is one of the most beautiful mosques in the East, the Jain style of architecture being plainly visible in its construction. Its external dimensions are 382 feet by 258 feet.

AHMADNAGAR, a district and city in British India, in the province of Gujrát, within the jurisdiction of the Governor of the Presidency of Bombay. The COLLECTORATE extends from 18° 6' to 19° 50' N. lat., and from 73° 40' to 75° 37' E. long., and contains the following eleven *tálukás* or sub-districts:—Nagar, Jámkhair, Párnair, Srígoná, Karat, Newasa, Kopargám, Sangamnár, Rahuri, Siogám, and Ankolá. A natural boundary is formed on the west of the Ankolá *táluka* by the Western Gháts, and further south, by the edge of the table-land of Párnair; on the S.W. the district is bounded by the Gor river; on the S. by the Bhímá and Sholápur collectorates; on the E. by the Nizám's dominions; on the N.E. by the Godávarí river; and on the N. by the Násik district. The total area of the district is returned at 4,209,036 acres, or 6576.62 square miles. Of the total area, 3,068,162 acres, or 4794.00 square miles, are cultivated; 121,474 acres, or 189.80 square miles, are cultivable, but not actually under tillage; and 1,019,400 acres, or 1592.81 square miles, are uncultivable. The last portion includes (besides arable lands) village sites, roads, tanks, rivers, &c. The population of the district of Ahmadnagar, according to the last census taken in December, 1889, is 791,228, divided into the following five classes:—Hindus, 716,820, or 96.62 per cent. of the total population; Mahometans, 42,435, or 5.49 per cent.; Buddhists, 12,547, or 1.62 per cent.; Christians, 941, or 0.12 per cent.; and other denominations, 1195, or 0.15 per cent. The bulk of the population consists of Marhattás and Kunbis, the latter being the agriculturists. On the north the district is watered by the Godávarí and its tributaries the Prawara and the Múlá; on the north-east by the Dor, another tributary of the Godávarí; on the east by the Séphani, which flows through the valley below the Bála Ghát range; and in the extreme south by the Bhímá and its tributary the Gor. The Siná river, another tributary of the Bhímá, flows through the Nagar and Karjat *tálukás*. The collectorate on the whole is fairly well watered,

although in some villages among the hills and spurs of the Western Gháts the supply is insufficient. The district is intersected by the Bombay and Agra road; a second road connects Puná *via* Serur with the town of Ahmadnagar, and is continued thence toward Málígám; a third road leads from Puná to Náráyangám, besides various cross-tracts and minor roads connecting the different towns of the district.

The only important industry is weaving. The principal agricultural products are wheat, gram, bajrá, joár, and tur dál. The early or spring crop is bajrá and tur dál; wheat, gram and joár being sown later in the season. Several other food grains are also raised; and sugar-cane, betel leaves, a little cotton, and all descriptions of vegetables are sown on suitable soils. The staple food of the people is bajrá and joár (coarse kinds of millet). The total revenue of the district is returned at nearly \$350,000; about \$700,000 being derived from the land revenue. The total annual expenditure is returned at \$250,000. The present land-settlement was introduced about 1844-45, and the thirty years' leases are now beginning to fall in. In a few villages which were transferred to Ahmadnagar from the Násik collectorate the leases have already expired, and a revision of the settlement is in progress. The following eight towns are returned as containing a population of upward of 5000 souls: Ahmadnagar, population, 37,492; Sangamnair, 9978; Páthárdi, 7117; Khurdá, 6889; Srígonda, 6175; Bhingar, 5752; Karjat, 5535; and Sonái, 5254. The municipal system has been introduced into the towns of Ahmadnagar, Sangamnair, and Bhingar. In the two first named the municipal revenue is derived from a house tax and octroi duties on goods and articles imported into the town for consumption. In Bhingar the municipal revenue is raised by the levy of a classified tax on professions and trades carried on within the town.

AHMADNAGAR CITY, the capital of the district of the same name, is situated in 19° 6' N. lat., and 74° 46' E. long. It is a town of considerable antiquity, having been founded, in 1494, by Ahmad Nizám Sháh, on the site of a more ancient city, Bhingar. This Ahmad established a new monarchy which lasted until its overthrow by Sháh Jahán in 1636. In 1759 the Peshwá obtained possession of the place by bribing the Mahometan commander; and in 1797 it was ceded by the Peshwá to the Marhattá chief Daulat Ráo Sindhiá. During the war with the Marhattás in 1803 Ahmadnagar was invested by a British force under General Wellesley, and captured. It was afterward restored to the Marhattás, but again came into the possession of the British in 1817, according to the terms of the treaty of Puná. The town has rapidly advanced in prosperity under British rule. It now contains a population of 37,492 souls, is an important station on the Great Indian Peninsular Railway, and has been created a municipality, as is mentioned above.

AHMEDPUR, a town of 30,000 people in the native State of Bahawalpur, India.

AHMED SHÁH, founder of the Duráni dynasty in Afghanistan, born about 1724, was the son of Sammaun-Kahn, hereditary chief of the Abdali tribe. While still a boy Ahmed fell into the hands of the hostile tribe of Ghilzais, by whom he was kept prisoner at Kandahar. In March, 1738, he was rescued by Nadir Shah, who soon afterward gave him the command of a body of cavalry composed chiefly of Abdalis. On the assassination of Nadir in 1747, Ahmed, having failed in an attempt to seize the Persian treasures, retreated to Afghanistan, where he easily persuaded the native tribes to assert their independence, and accept him as their sovereign. He was crowned at Kandahar in October, 1747, and

about the same time he changed the name of his tribe to Duráni. Two things may be said to have contributed greatly to the consolidation of his power. He interfered as little as possible with the independence of the different tribes, demanding from each only its due proportion of tribute and military service; and he kept his army constantly engaged in brilliant schemes of foreign conquest. Being possessed of the Koh-i-noor diamond, and being fortunate enough to intercept a treasure on its way to the Shah of Persia, he had all the advantages which great wealth can give. He first crossed to the Indus in 1748, when he took Lahore; and in 1751, after a feeble resistance on the part of the Mahometan viceroy, he became master of the entire Panjáb. In 1750 he had taken Nishapur, and in 1752 he subdued Kashmir. His great expedition to Delhi was undertaken in 1756 in order to avenge himself on the Great Mogul for the recapture of Lahore. Ahmed entered Delhi with his army in triumph, and for more than a month the city was given over to pillage. The Shah himself added to his wives a princess of the imperial family and bestowed another upon his son Timur Shah, whom he made governor of the Panjáb and Sirhind. As his viceroy in Delhi he left a Rohilla chief in whom he had all confidence, but scarcely had he crossed the Indus when the Mahometan vizier drove the chief from the city, killed the Great Mogul, and set another prince of the family, a tool of his own, upon the throne. The Mahrattá chiefs availed themselves of these circumstances to endeavor to possess themselves of the whole country, and Ahmed was compelled more than once to cross the Indus in order to protect his territory from them and the Sikhs, who were constantly attacking his garrisons. In 1758 the Mahrattás obtained possession of the Panjáb, but on the 6th January, 1761, they were totally routed by Ahmed in the great battle of Pánipt. In a later expedition he inflicted a severe defeat upon the Sikhs, but had to hasten westward immediately afterward in order to quell an insurrection in Afghanistan. Meanwhile the Sikhs again rose, and Ahmed was now forced to abandon all hope of retaining the command of the Panjáb. After lengthened suffering from a terrible disease, said to have been cancer in the face, he died in 1773.

AHN, JOHANN FRANZ, educationist, was born at Aix-la-Chapelle in 1796, and died Aug. 21, 1865, having from 1824 till 1863 held various scholastic offices in his native city and at Neuss. His French Grammar for Germans (1834) has gone through more than 200 editions, and was succeeded by similar works on English, Italian and Dutch. Ahn's method, an extension of Seidenstucker's, who died in 1817, is that of making the example precede the rule, so that a pupil learns a foreign language much as, when a child, he learned his own.

AIDE, HAMILTON, English poet and novelist, was born in 1830 at Paris, the son of an Armenian and of a daughter of Admiral Sir George Collier. He served seven years in the British army, and then, settling down in the New Forest, devoted himself to literature. Among his poems are *Eleonore* (1856), and *Songs without Music* (1882); among his novels, *Rita* (1859), *The Marstons* (1868), and *Passages in the Life of a Lady* (1887).

AHRIMAN or ARIMANES, the principle of evil, opposed to *Ormuzd*, the principle of good, the one being symbolized by darkness and the other by light. Both were visible manifestations of the Infinite Time, and existed from all eternity, according to the doctrine of the Magians. Zoroaster himself, however, seems to have taught that *Ormuzd* alone was eternal, while *Ahriman* was created. In the *Avesta* this world is represented as the theatre of a fierce conflict between the two spirits, which is to last for 12,000 years. In

the end Ahriman is to acknowledge the supremacy of Ormuzd.

AHUACHAPAN, an important trading town of San Salvador, Central America. Population (1889), 8,000.

AHWAZ, a town in Persia, on the left bank of the river Karoon. Though now an insignificant place, this ancient city extended 12 miles along the bank of the river. Ahwaz reached the height of its prosperity in the time of the earliest Mahometan caliphs.

AI, a royal city of the Canaanites, east of Bethel. It existed in the time of Abraham, who pitched his tent between the two cities, but it is chiefly noted for its capture and destruction by Joshua, who made it "a heap for ever, even a desolation." At a later period Ai was, however, rebuilt.

AIDAN, a king of Scottish Dalriada, who reigned about the close of the sixth century. During Aidan's reign the Scottish Dalriada was completely freed from subjection to the Irish monarchs.

AIDAN, Sr., first bishop of Lindisfarne or Holy Island, embraced a religious life in the monastery of Iona. Oswald, king of Northumbria, having requested a mission of monks from Iona to labor for the conversion of his subjects, Aidan was chosen by the abbot as leader of the expedition, and was consecrated a bishop about 634-35 A.D. Aidan died on the 31st of August, 651.

AIDE-DE-CAMP, a confidential officer attached to the "personal" or private staff of a general. In the field he is the bearer of the chief's written or verbal orders, and when employed as the general's mouthpiece must be implicitly obeyed. In garrison and quarters his duties are more of a social character—he superintends the general's household, writes and answers invitations, etc. Officers above the rank of captain are seldom taken as aides, and none of less than two years' service. In the United States army a lieutenant-general is allowed two aides and a military secretary, with the rank and pay of a lieutenant-colonel; three and two aides respectively are allotted to major-generals and brigadiers, selected in the former case from captains and lieutenants, in the latter from lieutenants in the army, but with no additional rank attached to their position.

AIDIN, or GUZEL-HISSAR, a town of Turkey in Asia, in the pashalic of Anatolia, about 70 miles southeast of Smyrna. It is beautifully situated near the river Meander, and is the residence of a pasha. Population, 30,000.

AIDS, a pecuniary tribute under the feudal system, paid by a vassal to his lord on particular occasions; originally a voluntary grant which in process of time became exigible as a right.

AIGRETTE, the French name of the Egret or lesser white Heron. It is also applied to a feather head-dress, and to an ornament of diamonds in the shape of a plume.

AIGUILLE (French, 'a needle'), an instrument used by engineers to pierce rock for the reception of explosives, now supplanted by the drill.

AIKIN, JOHN, M.D. (1747-1822), was born at Kibworth-Harcourt, England. He commenced his professional career as a surgeon at Chester; but, being unsuccessful, he at an early period devoted himself to literary pursuits. Dr. Aikin's reputation chiefly rests on his endeavor to popularize scientific inquiries. In conjunction with his sister, Mrs. Barbauld, he commenced the publication of a series of volumes on this principle, entitled *Evenings at Home* (6 vols., 1792-95), a popular and interesting work, chiefly commendable for the purity of the principles it inculcates, and the pleasing views it gives of human nature. He also wrote a valuable *Biographical Dictionary*, in ten volumes (London, 1799-1815), which formed one of his most important literary productions.

AIKIN, LUCY, daughter of the preceding, a well-known historical writer, was born at Warrington, England, on the 6th of November, 1781. After rendering valuable assistance to her father in several of his later works, she commenced her own career as an author by the publication of several books for the young, the most important of which were the *Adventures of Rolando*, a translation, and *Lorimer*, a tale. In 1818 she published her *Memoirs of the Court of Queen Elizabeth*, the first and best of the series of historical works on which her reputation rests. It was very popular, and passed through several editions. The *Memoirs of the Court of King James I.* (1822) was highly commended in the *Edinburgh Review*, which pronounced it "a work very nearly as entertaining as a novel, and far more instructive than most histories." Miss Aikin died at Hampstead, where she had resided for forty years, on January 29, 1864.

AIKMAN, WILLIAM, a celebrated portrait-painter, born at Cairney, Scotland, on the 24th of October, 1682. He was intended by his father for the bar, but followed his natural bent by becoming a pupil under Sir John Medina, the leading painter of the day in Scotland. Perhaps his most successful work was the portrait of the poet Gay. He died in June, 1731, leaving unfinished a large picture of the royal family.

AILANTO (*Ailanthus glandulosa*), a lofty and beautiful tree, native of China and Japan, now acclimated in the United States and extensively used as a shade tree for streets and avenues. The wood is valuable for cabinet work.

AILRED, EALRED, ETHELREDUS, ALUREDUS, an English ecclesiastic and historian, born at Hexham in 1109. The king is said to have offered him a bishopric, which he refused, preferring to become a monk in the Cistercian abbey of Rievaulx, Yorkshire. He died in 1166.

AILS CRAIG, a remarkable island-rock at the mouth of the Firth of Clyde, off the coast of Ayrshire, Scotland. It is of a conoidal form, with an irregular elliptic base, and rises abruptly from the sea to the height of 1,139 feet. A columnar cave exists toward the north side, and on the eastern are the remains of a tower, with several vaulted rooms.

AIN, a department on the eastern frontier of France. It has an area of 2,241 square miles. The east of the department is very mountainous, being traversed by the southern portion of the Jura range, but in the northwest the surface is comparatively level, and in the southwest flat and marshy. The climate is usually cold, but on the whole healthy, except in the damp marshy districts on the west. The soil in the valleys and plains of the department is fertile, producing wheat, barley, maize, rye, and fruits of various kinds, as well as wine of excellent quality. The chief mineral product is asphalt, besides which potter's clay, iron, building stone, and the best lithographic stone in France, are produced in the department. There are many corn and saw mills on the mountain streams; and cotton, linen and silk fabrics, coarse woolen cloth, paper, and clocks are manufactured to a limited extent. Ain is divided into five arrondissements—Bourg and Trevoux in the west, and Gex, Nantua, and Belley in the east; containing in all 36 cantons and 452 communes. Bourg is the capital, and Belley is the seat of a bishop. Population of Ain in 1901, 349,205.

AINAD, a town of Arabia, in the province of Hadramaut. Near it is the tomb of a Moslem prophet much frequented by pilgrims, of which a great annual fair is also held. The population (1900) was said to be about 10,000.

AIR-BRAKE

AIR-BRAKE, a mechanical device for regulating the speed of railroad trains and of stopping them. In its present complete and complex form the modern air-brake is the outcome of a system of development co-ordinate with the progress of railroad operation, each being materially influenced by that of the other.

Each marked advance in the development of the air-brake is directly due to the ingenuity and quick perception of Mr. George Westinghouse, and a brief review of his air-brake in its earliest form will help to a clear and comprehensive understanding of the construction and operation of the air-brake of more modern times. During the course of its present development, it has been known and operated under three different forms:

- (1) The *straight* air-brake.
- (2) The *automatic* air-brake.
- (3) The *quick-action automatic* air-brake.

Each fulfilled the requirements of its day and each laid the foundation for the one that followed.

THE STRAIGHT AIR-BRAKE.

Mr. Westinghouse introduced the straight air-brake in 1869. An air compressor was attached to and operated by steam from the locomotive, which compressed atmospheric air into a storage reservoir, also located upon the locomotive. A line of ordinary gas or water pipe commonly called the *train-pipe*, extended from the reservoir, through the engineer's cab and back underneath the tender and each of the cars of the train. This pipe was connected, between the cars, by means of a rubber hose and suitable couplings, forming one continuous line from engine to rear car. Under and near the center of each car was placed a brake cylinder, which was connected with the train-pipe by means of a short branch pipe. This brake cylinder contained a piston with a stem which, through a system of levers and rods, was connected with the brake shoes that were to be applied to the car wheels to check the motion of the train. An operating valve, consisting of a three-way cock, was placed in the cab within reach of the engineer and in the line of the train-pipe. By the manipulation of this valve the engineer could force a flow of air from the reservoir into the train-pipe and connected brake cylinders, thus forcing out the pistons and applying the brake to the wheels. When a sufficient amount of air had thus been admitted to the brake cylinders to meet the necessary requirements, the engineer had but to cut off a further flow of air from the reservoir, at the same time retaining in the cylinders the amount of air pressure that had already been applied. By another turn of the handle the engineer could discharge the air accumulated in the train-pipe and brake cylinders, and release the pressure of the shoes upon the car wheels.

The engineer could so vary the pressure of the air in the brake cylinders, and consequently the pressure of the brake shoes upon the wheels, that a train could be not only regulated for going down grade and stopping at stations, but could also be brought to a stop when necessary. This form of air-brake was extensively used upon short trains at that period; but, as the length of trains increased, it was found that considerable time was lost in the application of the brakes on account of the time required for the compressed air to travel from the storage reservoir to the brake cylinders, this operation being very seriously retarded by the frictional resistance of the walls of the train-pipe to such a rapid passage of compressed air as would be required. Another difficulty which had to be arranged for, and, which was of not infrequent occurrence, was that of a car becoming detached

while in transit, thus breaking the continuity of the train-pipe and rendering the engineer's efforts to stop the train futile; that is, so far as the detached cars were concerned. Again, should the rubber hose connecting the different cars burst, which occasionally happened, or should any other portion of the apparatus become ruptured, the escape of the compressed air at such point of rupture rendered the entire system valueless.

THE AUTOMATIC AIR-BRAKE.

In 1873 Mr. Westinghouse began introducing an automatic air-brake which was designed to remedy the defects of the straight air-brake and meet the more exacting requirements of the time. The automatic was similar in construction to the straight air-brake, except that it provided for a storage reservoir upon each car of sufficient capacity to supply the cylinder of that car. It also provided a valve mechanism, called a triple valve, which was located in the branch pipe leading from the train-pipe to the brake cylinder, and by variations in the air pressure of the train-pipe controlled the operation of the brake cylinder. It also provided a pipe leading to the new storage reservoir. This valve was called a triple valve because it performed three distinct functions: (1) It permitted the air to flow from the pipe into the storage reservoir for the purpose of charging the latter with air pressure; (2) it permitted the air to flow from the reservoir into the brake cylinder for the purpose of applying the brakes; and (3) it permitted the compressed air to flow from the brake cylinder to the atmosphere, removing the pressure from the cylinders and releasing the brakes. With the adoption of individual car reservoirs, the storage reservoir upon the locomotive became known as the *main* reservoir, and those upon the cars as *auxiliary* reservoirs.

The triple valve is the main characteristic of the automatic air-brake, as it controls all of the operations of the brakes on individual cars.

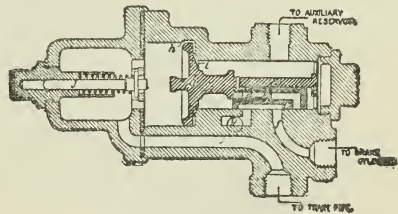


FIG. 1.—NORMAL POSITION.

Fig. 1 illustrates the triple valve with all the parts in their normal positions when the brakes are not applied. The brake cylinder, the auxiliary reservoir and the location of the several connections of the branch pipes to the train-pipe, are all indicated. A piston *a* is so adapted as to move back and forth in a piston chamber, from which the piston stem *b* extends forward into a smaller valve-chamber containing a slide valve *c*, which is loosely confined between two shoulders upon the piston stem. A small poppet-valve, *d*, called the graduating valve, within the slide valve *c*, is secured by a pin to the piston stem *b*. When the engineer admits compressed air into the train-pipe from the main reservoir, it enters the triple valve structure through the passage ways leading to the left of the piston *a*, where, if not already in the positions shown in Fig. 1, the piston and its accompanying parts are forced by the compressed air. With the piston in this

position, the small feed grooves *h* and *i* permit the compressed air to gradually pass from the train-pipe, around the piston, into the valve chambers and thence into the auxiliary reservoir, charging the latter with the same pressure of air that exists in the train-pipe. The brake apparatus is now ready for operation.

When the engineer wishes to apply the brakes, he discharges through his operating valve a portion of the air contained in the train-pipe, thereby slightly reducing the air pressure in the train-pipe and the chamber at the left of piston *a*. The compressed air in the auxiliary reservoir being unable to pass out rapidly through the small feed grooves *h* and *i*, the piston *a* is forced to the left on account of the superior pressure remaining in the auxiliary reservoir and valve chamber. The forcing of the piston to the left cuts off communication between the auxiliary reservoir and the train-pipe through the feed groove *h*, at the same time withdrawing the graduating valve *d* from its seat in the slide valve. The shoulder at

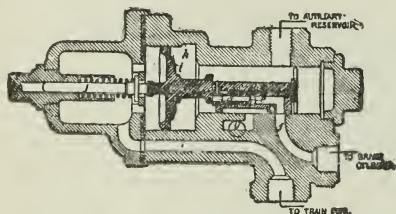


FIG. 2.—WITH BRAKE APPLIED.

the end of the piston stem *b* then comes into contact with the end of the slide valve *c*, which subsequently accompanies the piston in its progress toward the left until the latter is finally arrested by coming into contact with the stem *j*, which is supported in the position shown by a spring called a graduating spring. The positions of the parts at this period are clearly shown in Fig. 2.

Compressed air now passes out from the auxiliary reservoir through a transverse port *e* in the slide valve, the passage way is uncovered by the removal of the graduating valve *d* and the passage way *f* and connecting pipe to the brake cylinder, where it forces out the brake cylinder piston and causes the brake shoes to be applied to the wheels. The air pressure in the auxiliary reservoir and valve chamber of the triple valve is necessarily reduced by the discharge of air from the auxiliary reservoir, such discharge and consequent reduction of pressure continuing until the pressure becomes slightly lower than the air in the train-pipe and the connecting chamber at the left of the triple valve piston. The excess of pressure then existing upon the left face of the piston *a* causes it to move to the right until the graduating valve *d* becomes seated in the slide valve, thereby preventing further discharge of air into the brake cylinder. The air pressure remaining in the brake cylinder causes the brake shoes to remain applied to the wheels, effectually retarding the progress of the car.

GRADUATING THE PRESSURE.

Should the engineer desire to increase the retarding force of the brakes, he discharges a further portion of the air remaining in the train-pipe through the operating valve. This reduces the pressure in the train-pipe, as well as in the connecting chamber at the left of the piston *a*, the excess of pressure in the auxiliary reservoir and chamber at the right of the piston again causing it to move to the left until stopped by the stem *j*, thereby moving the graduating valve *d* and reopening the passage through the slide valve for the further discharge of air into the brake cylinder from the auxiliary reservoir. This discharge is continued until the air pressure in the reservoir and the chamber at the right of the piston *a* has again become reduced to a point a little below the remaining pressure in the train-pipe, when the preponderance of the latter upon the left face of the piston moves

it inwardly and again cuts off further discharge of air to the brake cylinder by receding the graduating valve *d*. This graduating process may again be repeated by the engineer, if the pressure of air in the brake cylinder is still found by him to be insufficient to meet the demands of the occasion. Thus the engineer is able to apply the brakes with the various degrees of force required for different conditions, from the checking of the speed of the train to the smooth and gentle stopping at stations.

The engineer moves the handle of his operating valve into the position for restoring communication between the main reservoir and the train-pipe whenever he wishes to discharge air from the brake cylinders and release the brakes. This elevates the air pressure in the train-pipe and acts upon the left face of the triple valve piston, moving it with its connected valves to the right until it again reaches the position shown in Fig. 1. This position of the slide valve brings the passage way *f*, which is connected with the brake cylinder, into communication with the passage way *g* by means of a cavity in the lower face of the slide valve. The air in the brake cylinder is thereby discharged into the atmosphere and the brakes become released. At the same time the feed groove *h* establishes communication between the train-pipe and the auxiliary reservoir, causing the compressed air from the main reservoir on the locomotive to pass into and recharge the auxiliary reservoir, restoring it again to a condition of readiness for the application of the brakes.

DISCHARGE IN AN EMERGENCY.

Should the engineer desire to stop the train quickly in an emergency, he at once discharges a considerable quantity of air from the train-pipe through his operating valve, rapidly reducing the pressure upon the outer face of the triple valve piston. As a result, such a preponderance of pressure is brought to bear upon the right face of the piston that the movement of the latter toward the left cannot be resisted by the spring which supports the stem *j*, and permits the piston to continue its movement to the left until stopped by reaching the end of the chamber in which it operates. In this position the slide valve *c* moves far enough to the left to completely uncover the passage way *f* leading to the brake cylinder. This results in a less obstructed discharge of air from the auxiliary reservoir to the brake cylinder, and the maximum air pressure which can be supplied in the cylinder by the air in the auxiliary reservoir is thereby attained. But the application of the brakes need not be confined to the engineer's manipulation of the operating valve, but may result from any cause by which the train-pipe air pressure may be sufficiently reduced, hence its designation—*automatic*. For example, should any portion of the train become detached, or should the train-pipe or hose become ruptured, there at once follows a reduction of air pressure in the train-pipe and an automatic application of all the brakes on the cars. This feature of the automatic brake is very pronounced, for there is no other operation of an air-brake so essential as that of a speedy and reliable retarding action. Of all the many manipulations of the air pressure, that which permits it to escape into the atmosphere from the train-pipe is the simplest and most surely attainable. In this manner, the quick response of the air-brake when emergency requires it is guaranteed and this has done much toward placing it in the front rank of railroad safety appliances. No accidental disorder can prevent its successful application in an emergency. By means of the engineer's operating valve, or of a valve which is called "the conductor's valve," and is connected with the train-pipe in each car, or by the occurrence of any disorder which permits the escape of the air pressure in the train-pipe, the train is automatically brought to a stop—in the latter case, calling attention to the disorder and giving an opportunity for such repairs as may be required before the train again proceeds.

POWER BRAKES FOR FREIGHT TRAINS.

The automatic air-brake fully met the requirements of the day, and was adopted by all important railroads for

passenger train service; but, in the development of railroad transportation it became apparent that, owing to new conditions which were discovered from time to time, the air-brake was inadequate for use on long freight trains. During the year 1886, a committee of the Master Builders' Association met at Burlington, Iowa, for the purpose of making a series of test trials, and it was fully demonstrated that no power brake then extant met the operating requirements of a long freight train. While the promptness and efficiency of the automatic air-brake then used on passenger trains were fully recognized, it was found that the reduction of air pressure in the train-pipe of long freight trains, sufficient to act upon the rear end of the train, consumed too much time when that reduction could only be effected by the discharge of the air by means of the operating valve in the hands of the engineer. For example, a freight train of 60 cars is about 2,400 feet long. In an emergency, about 20 seconds elapsed between the time the engineer began the discharge of the air at his brake valve and that at which the air pressure in the train-pipe upon the rear cars became sufficiently reduced to cause the triple valve to operate, owing to the resistance upon the walls of the train-pipe. The brakes upon all forward cars could be applied promptly, and as a consequence the forward cars became reduced in motion much more rapidly than those in the rear. As a result, the rear cars plunged forward with a force that almost equalled a collision, oftentimes doing much damage to the forward cars and their lading.

Thus it became manifest that the usefulness of the automatic air-brake was contingent upon some discovery which would reduce the interval of the application of the brakes upon the forward cars from those of the rear. It was equally apparent, by means of thorough tests made, that but two methods could be utilized for securing a more nearly simultaneous application of the brakes to all cars. First, it would be necessary to reduce the air pressure in the train-pipe so gradually that the reduction would be nearly uniform throughout the train; or, second, to provide a series of openings in the train-pipe, in addition to that through the engineer's brake valve, in order that the air might be discharged at different points throughout the train at approximately the same time. The first method proved satisfactory for the ordinary application of brakes in regular service, but as it consumed so much time it could not be relied upon when an emergency arose which required prompt and efficient action. Therefore, the second method became the only practical solution of the application of the automatic air-brake as an effective safety appliance on freight trains.

THE QUICK-ACTION AIR-BRAKE.

Early in 1888 Mr. Westinghouse introduced the quick-action air-brake as a result of the development of this principle. The train-pipe upon each car was provided with a vent valve which, in an emergency and then only, was to be operated by means of the triple valve. Mr. Westinghouse discovered that by discharging the air (vented from the train-pipe in emergency applications) into the brake cylinder instead of into the atmosphere, a very much more powerful and effective application of the brakes could be secured than was required for use in the ordinary operation of the brakes in regular service. With the simple addition of the train-pipe vent valve, and the means for causing it to operate in emergency applications, there is no difference between the mechanism of the quick-action automatic air-brake and the one hitherto employed in the air-brake system. Fig. 3 illustrates a sectional view of the quick-action triple valve.

The upper portion of this triple valve does not differ in its construction from that already described in connection with the automatic air-brake, except that the main slide valve *c* is longer at the forward end, and this added portion is supplied with a somewhat restricted port *h*. In all ordinary applications of the brake, such as occur from a moderate reduction of the train-pipe air pressure, this portion of the triple valve is alone operative.

The additional quick-action mechanism consists of the supplemental piston *m*, situated in the cylindrical chamber below the slide valve, an emergency valve *n* with a stem extending upward to the piston, and a check valve *o* directly below the emergency valve. A light spring,

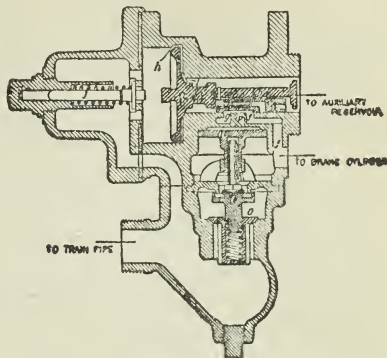


FIG. 3.—QUICK-ACTION AIR-BRAKE.

which is situated between the check valve and the emergency valve serves under ordinary conditions to support the emergency valve and the supplementary piston in the positions shown. The main valve chamber and the chambers above the supplementary piston *m* are connected by a port or passage way *p*, indicated by dotted lines. This port is normally covered and closed by the slide valve *c*, being uncovered only when the triple valve piston *a* moves to the left with sufficient force to compress the supporting spring of the stem *j*, and thus complete its full traverse to the end of its chamber. The complete movement of the triple valve piston uncovers the port *p* through an opening in the lower face of the slide valve *c*, which cannot be illustrated, however, as both it and the dotted port *p* are situated behind the plane of the section shown.

MAKING A SUDDEN STOP.

If, owing to an emergency, the engineer finds it necessary to bring the train to a sudden stop, he quickly discharges the air from the train-pipe by moving the handle of the brake valve into a position whereby a sudden and

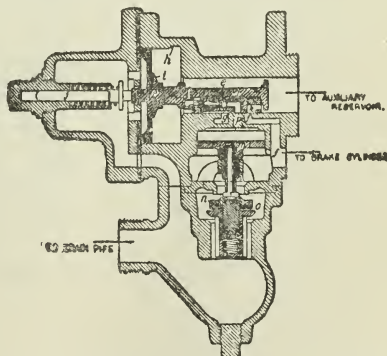


FIG. 4.—QUICK-ACTION AIR-BRAKE, EMERGENCY APPLICATION.

material reduction of air pressure is effected in the train-pipe upon the first car and in the connected chamber at the left of the triple valve piston *a*. As a result, the preponderance of air pressure from the auxiliary reservoirs upon the right face of the triple valve piston causes the

piston to move quickly to the left, and compresses the supporting spring of the stem *j* until it reaches the end of its chamber. With the uncovering of the passage way *p* the upper face of the supplemental piston *m* is forced downward by the air pressure from the auxiliary reservoir and the emergency valve *n* is opened, as illustrated in Fig. 4.

It is necessary to clearly comprehend three very essential conditions which exist at this instant; *viz.*, (1) During the almost instantaneous process described above, no compressed air has yet entered the brake cylinder from any source; (2) owing to the very restricted character of the port *k* in the slide valve, the process of discharging compressed air into the brake cylinder from the auxiliary reservoir must be a comparatively slow one; and (3) although the air pressure in the train-pipe has been suddenly and materially reduced below the pressure in the auxiliary reservoir, to the extent of some five or ten pounds, or possibly more, it is still perhaps some 60 to 65 pounds, and it has, by merely lifting the check valve *a*, a capacious and unobstructed passage way, past the open emergency valve *n*, into the as yet empty brake cylinder. Owing to the existence of these conditions, the check valve *a* is lifted from its seat against the light spring resistance of its spring (as indicated in Fig. 4) and the air of the train-pipe rushes into the brake cylinder and reduces very greatly the air pressure of the train-pipe in that vicinity. The filling of the brake cylinder with air at the reduced pressure of that of the train-pipe immediately causes the spring above the check valve *a* to be closed, preventing a return of any air from the brake cylinder to the train-pipe, as the pressure in the latter becomes further reduced. The air in the auxiliary reservoir, which has been comparatively slowly discharging during the operation just described, continues to discharge through the port *k* and the passage way *f*, and to add to the contents of the brake cylinder until equilibrium of pressure is established in the reservoir and in the brake cylinder.

With the sudden discharge of a large quantity of air from the train-pipe into the brake cylinder of the first car, not only is a very quick and powerful application of the brakes upon that car produced, but it also acts upon the left face of the triple valve piston *a* of the second car by a sudden and very material reduction of the air pressure, and reproduces the conditions necessary for the complete movement to the left of the triple valve piston and a repetition of the operation which occurred in the triple valve of the first car. Here, the quick action of the triple valve of the third car is actuated by the same operation of the triple valve of the second car, and so on throughout the entire length of the train. These successive operations are accomplished with such astonishing rapidity that the brakes can now be applied with entire satisfaction on a train of 60 cars in three seconds, where formerly it required twenty.

From the introduction of the simplest form of air-brake in 1869 to 1900 the invention went forward with rapid strides, and the beginning of the latter year found two distinct quick-action automatic air-brake systems in use on all important railroad lines. The first covered only passenger trains, where the customary operations of every-day service require a brake of only moderate power; the second consisted of a brake

of very high power and violent application, to be used when emergencies required the most energetic means to avert the destruction of life and property. The latter practically superseded all other forms of air-brake, and in 1900 over one million cars were supplied with the latter device.

It has already been noted that the rate of rapidity, or the suddenness with which the reduction of the air pressure in the train-pipe takes place, determines whether an emergency or a service application of the brakes is desired. When the air pressure in the train-pipe is reduced comparatively slowly, the resistance of the spring supporting the stem *j* terminates the leftward movement of the triple valve piston in such a position that the compressed air of the auxiliary reservoir becomes discharged into the brake cylinder, co-ordinately reducing the air pressure of the auxiliary reservoir (which acts upon the right face of the triple valve piston) with the continued reduction of the air pressure in the train-pipe (acting upon the left face of the piston). Consequently the required preponderance of air pressure upon the right face of the piston necessary to compress the spring in the stem *j* does not occur. It is only when the air pressure, acting upon the left face of the triple valve piston is reduced much more rapidly than the discharge of auxiliary reservoir air to the brake cylinder will permit the air pressure upon the right face of the piston to be reduced, that the piston makes its complete movement to the left and causes a quick application of the brakes throughout the train. The operating valve of the engineer's brake is, therefore, necessarily provided with such means as will readily enable the engineer to discharge air from the train-pipe with only the rapidity required for service application; or, to discharge the air with such greater rapidity as shall cause the emergency application of the brakes. The provision of a stored pressure in the main reservoir upon the locomotive, higher than that usually charged into the train-pipe and brake apparatus, is found very desirable for temporary use in effecting a prompt release of the brakes, owing to the necessity of elevating the air pressure in the train-pipe as rapidly as possible to a point somewhat above

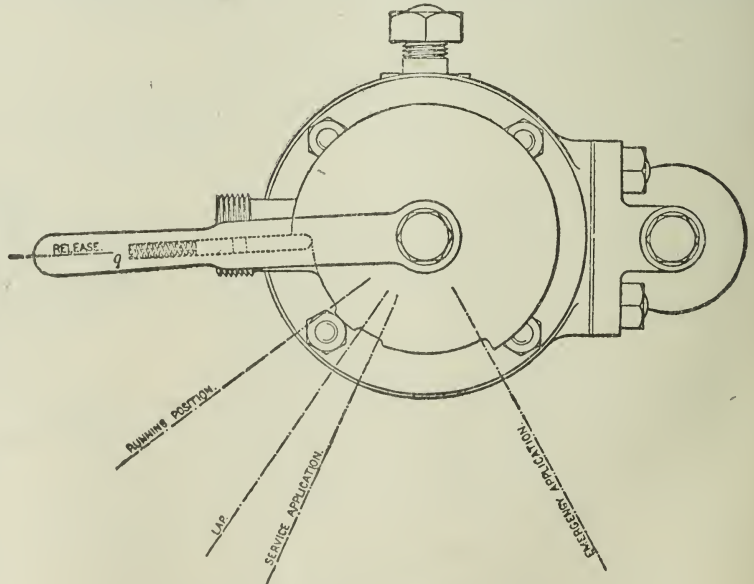


FIG. 5.—ENGINEER'S OPERATING VALVE.

the pressure of the air left in the auxiliary reservoirs after an application of the brakes. Thus, the primitive three-way cock, used for an engineer's brake operating

a reservoir or chamber of sufficient volume to permit an accurate reduction of air pressure therein through the discharge of a portion of the compressed air therefrom to the atmosphere. This small reservoir provides such a volume for the chamber *y* as could not be otherwise secured without greatly increasing the size of the engineer's valve structure, which would be a great inconvenience in the engineer's cab, and can be located in any convenient place, out of the way of the engineer.

with a pressure of about 90 pounds per square inch, at which point the pump governor, which is connected with the main reservoir by a pipe, acts in such fashion as to cut off the steam supply for the pump and stop its operation.

It is also to be noted that, in this position of the rotary valve *r*, a passage way is provided which connects the passage ways *e* and *x* so that the chamber *y* and the small reservoir connected therewith are in direct communication with the train-pipe and are charged with the same pressure of air as exists in the train-pipe. If any reduction of the air pressure should occur through leakage at any point

of the apparatus, while the air-brake mechanism throughout the train is thus charged with the proper air pressure, the effect is to diminish the pressure upon the upper face of the piston *l* of the feed valve, thus allowing the piston to be forced upward by the spring *s*, unseating the supply valve *v* and permitting air from the main reservoir to flow into the train-pipe and restore the pressure therein, and in the connected reservoirs, to 70 pounds. Thus, a reduction of pressure in the main reservoir, from any cause, acts upon the pump governor to restore the steam supply to the air pump and thus replenish the pressure in the main reservoir and restore it to 90 pounds.

Fig. 7 illustrates the position of the rotary valve *r* when the engineer brings his handle into the proper position for making a service application. This position of the rotary valve cuts off all communication between the main reservoir and all other parts of the apparatus, as well as the communication between the chamber *y* above the piston *u* and the train-pipe. At the same time the passage way *x* is placed in communication with the passage way *z* (by means of a small cavity in the rotary valve *r*) so that the air from the chamber *y* and the small reservoir connected to it may be discharged into the atmosphere. As a result of reducing the air pressure upon the upper face of the piston *u*, while the air pressure of the train-pipe below the piston remains unchanged, the piston *u* is forced upward, the valve *w* is unseated and the air is discharged directly to the atmosphere from the train-pipe through the train-pipe discharge passage. The pipe connecting the chamber *y* with the small reservoir is connected with an air pressure gauge by means of a branch pipe, enabling the engineer to see how much

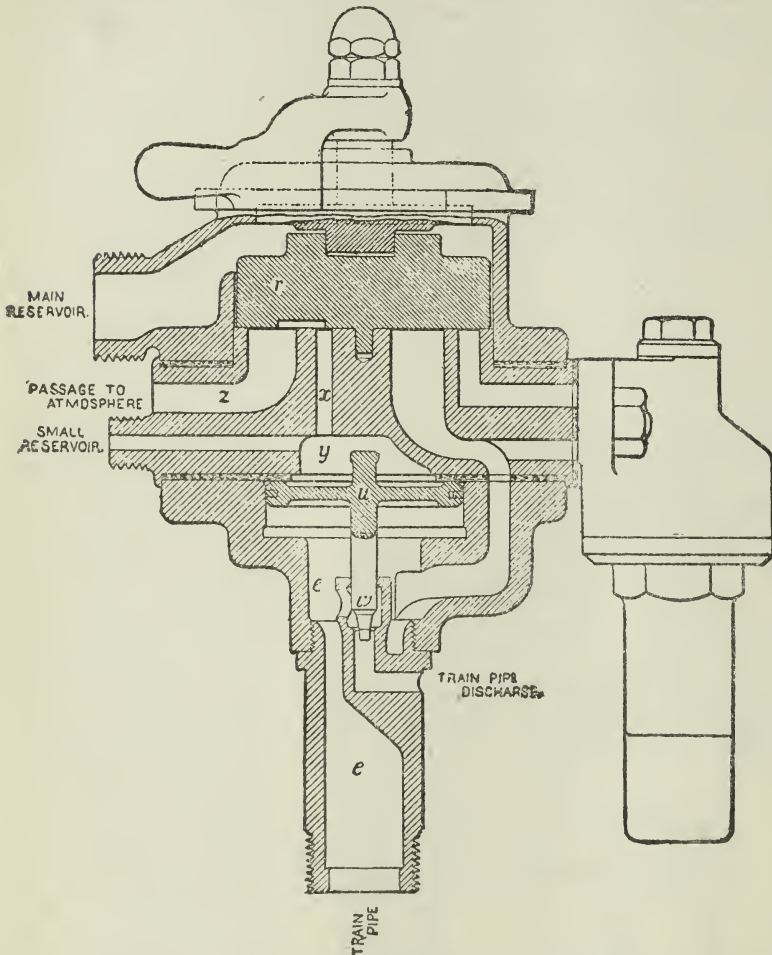


FIG. 7. ENGINEER'S OPERATING VALVE, SERVICE APPLICATION.

The rotary valve *r* is shown in Fig. 6 with the handle in running position, with a passage way through the valve which conducts air from the main reservoir to the passage way *g* leading to the feed valve. The course of the air is as follows: Below the supply valve *v* into the chamber above the piston *l* and through the passage ways *l* and *e* into the train-pipe and auxiliary reservoirs upon the cars. As soon as the train-pipe and auxiliary reservoirs are charged with a pressure of 70 pounds per square inch, the piston *l* is forced downward and the spring *s* is compressed; the supply valve *v* becomes seated and further communication between the main reservoir and the train-pipe is cut off. With the car apparatus ready to supply the brakes whenever desirable, the air pump upon the locomotive continues to compress air into the main reservoir until the latter has been charged

the air pressure in chamber *y* has been reduced by discharging the air therefrom. When the engineer has reduced the air pressure to the desired extent he moves the handle into a position which cuts off all communication between the respective passage ways. The air continues to discharge through the train-pipe discharge passage until the air pressure of the train-pipe has been reduced slightly below that to which the pressure in the chamber *y* was reduced by the discharge of air from that chamber into the atmosphere. The excess of pressure upon the upper face of the piston *u* causes it to move downward and reset the valve *w*, thus shutting off further discharge of air from the train-pipe to the atmosphere. Should the engineer subsequently wish to apply the brakes with greater force, the handle is again moved in the position for service application and an additional quantity of air is discharged from the chamber *y* to further reduce the air pressure therein. Thus, the piston *u* is again forced upward, the valve *w* again unseated, and further air discharged from the train-pipe.

AINMULLER, MAXIMILIAN EMANUEL, founder of a new school of glass-painting, was born at Munich on the 14th of February 1807. He was induced, by the advice of Gärtner, director of the royal porcelain manufactory, to devote himself to the study of glass-painting, both as a mechanical process and as an art, and he made such progress that in 1828 he was appointed director of the newly-founded royal painted-glass manufactory at Munich. The method which he gradually perfected there was a development of the enamel process adopted in the Renaissance, and consisted in actually painting the design upon the glass, which was subjected, as each color was laid on, to carefully-adjusted heating. With a few exceptions, all the windows in Glasgow cathedral are from his hand. Specimens may also be seen at St. Paul's cathedral and St. Peter's College, Cambridge. On the Continent it must suffice to mention Cologne cathedral as containing some of his finest productions. He died 9th December 1870.

AINOS, the name of a small but remarkable tribe in Japan, found chiefly in the Island of Yesso. They are different in race and character from the ordinary Japanese, and seem to have been the earliest inhabitants of the country. They were in 1900 less than 20,000.

AINSWORTH, HENRY, divine and scholar, was born "about 1560" at Pleasington, near Blackburn, Lancashire, having been second son of Lawrence Ainsworth of Pleasington Hall. According to tradition, he was a Roman Catholic, and a younger brother, John, a Protestant; and the two brothers, entering into a written controversy, mutually converted each other—Henry having embraced Protestantism, and John, Popery. He associated with the Puritan party in the Church of England, and eventually adopted the platform of the Independents as represented by the Brownists. He was driven from his native country by the state proscription of the sectaries before the year 1593. He is found resident in "a blind lane at Amsterdam" 1595-6. His exile must have reduced him to extreme poverty. He is stated to have been a "porter" to a scholarly bookseller in Amsterdam, who, on discovering his skill in the Hebrew language, made him known to his countrymen. His memory abides through his rabbinical learning. The ripe fruit of many years' diligence appeared in his *Notes on Genesis, 1616; Exodus, 1617; Leviticus, 1618; Numbers, 1619; Deuteronomy, 1619; Psalms, 1612, 2d edition, 1617; Song of Solomon, 1623*. These were collected in folio in 1627, and again in 1639, and later in various forms. From the outset the *Annotations* have taken a commanding place, especially among Continental scholars, as witness Clement, Dornius, Voght, Lillenthal, and Simon, the last urging Catholics to study and value them. There is nothing more striking in the career of Ainsworth than the reported manner of his death, which took place at Amsterdam in 1622-23. It is stated that, having found a diamond of great value, he advertised it; and when the owner, who was a Jew, came to demand it, he offered the finder any gratuity he sought. Ainsworth, though poor, requested only of the Jew that he would procure him a conference with some of his rabbis upon the prophecies of the Old Testament relating to the Messiah, which the Jew promised; but not having interest to obtain such a conference, it is thought that he contrived to get Ainsworth poisoned shortly afterward.

AINSWORTH, ROBERT (1660-1743), author of a well-known Latin dictionary, was born at Woodvale, near Manchester. After teaching for some time in Bolton, he removed to London, where he conducted a boarding-school, first at Bethnal Green, and then at Hackney. Proposals for the preparation of a Latin dictionary were made to him in 1714, but the work was

not published till 1736.

AINTAB, a large garrison town on the northern frontier of Syria. It has a considerable trade, chiefly in hides and leather, and cotton of coarse quality is grown in the district. Population, about 20,000.

AIR was the name formerly given to all gaseous substances. The gas now known as oxygen, for instance, was named by Priestley *dephlogisticated air*, in contradistinction to nitrogen or azote, which was *phlogisticated air*. So hydrogen gas was known to the early chemists as *inflammable air*, carbonic acid gas as *fixed air*, &c. The name is now ordinarily restricted to what is more accurately called atmospheric air—the air we breathe—the invisible elastic fluid which surrounds the earth, extending to an unknown height. The properties of this fluid will be fully considered under such headings as **ATMOSPHERE, BAROMETER, CHEMISTRY, VENTILATION, &c.** Reference may be made here to the mechanical use of air as a moving power, or rather as a means for transferring power, just as it is transferred by a train of wheelwork. Compressed air can be employed in this way with great advantage in mines, tunnels, and other confined situations, where the discharge of steam would be attended with inconvenience.

AIR-BEDS, CUSHIONS AND PILLOWS, are manufactured from rubber cloth, an air-tight fabric consisting of two pieces of cloth united by an interposed layer of rubber. They are inflated by means of the mouth or of a pair of bellows, and a screw stop-cock prevents the escape of air. They are valuable in cases of sickness, but are neither so lasting nor so comfortable as **WATER BEDS (q.v.)**

AIR-BLADDER, or SWIMMING-BLADDER, a sac pushed out from the alimentary canal of fishes, and discharging a respiratory or a hydrostatic function.

AIR-CELLS, or AIR-SPACES, in plants, are cavities containing air in the stems or leaves, and are especially large and numerous in aquatic plants.

AIR-ENGINE. Engines which have for their working fluid heated air instead of steam are called "air-engines." The name "caloric engine" has also been applied to them, but is not to be commended, for they have no more right to that title than steam-engines—the useful effect of both machines being due to the transformation of heat into mechanical energy, the air in the one case and the steam in the other being merely convenient media through which to effect that transformation.

The utilisation of the expansion of heated air for driving an engine has for many years been a subject which has exercised the ingenuity of inventors. The history of air-engines has, however, been little more hitherto than a history of failures, and they are as far now from superseding steam-engines as they were fifty years ago. This is owing mostly to the fact that the inventors have too often worked empirically, without any real knowledge of the conditions under which, and under which only, the real advantage of the fluid could be attained, and have therefore continually violated these conditions. There are also certain constructive difficulties in the way of making a successful air-engine which have never been fully overcome. It should be distinctly understood that, regarded simply as a medium for transforming heat into work, air possesses *no* advantage over steam or any other fluid. Its advantage is, that it can be used with safety at much higher temperatures than steam (and therefore a larger proportion of the heat given to it can be transformed into work), and that by employing the gases of combustion in the cylinder much heat can be utilised which with steam-engines is necessarily wasted.

AIR-GUN, a weapon like a common gun in shape, in which the force employed to propel the bullet is the elas-

ticity of condensed atmospheric air. It has attached to it, or constructed in it, a strong metal chamber, into which air is forced by a condensing syringe (see PNEUMATICS). In this way a pressure may be obtained of several hundred atmospheres. When a trigger is touched, the condensed air rushes into a space behind the bullet with such force as to propel it from the barrel to a considerable distance.

AIR-LOCKS are used in connection with caissons for engineering work under water, and serve as a means of entrance and exit for the workmen.

AIR-PUMP, an apparatus by means of which a closed vessel can have the air it contains removed from it. It consists essentially of two parts—a receiver, from which the air is to be exhausted; and a pump, to perform the work of exhaustion. The receiver is in general made of glass, in order that the condition of objects placed within it for the purpose of experiment may be readily seen by the operator. It is open at the bottom, and has its lower edge accurately ground; when in its place in the air-pump it stands upon a smooth brass plate. The pump itself is a brass cylinder, having a piston in it, which can be moved backwards and forwards by means of a rod, in the usual way. At the end of the cylinder nearest the receiver is placed a small valve, in the piston itself is another (or some mechanism which serves the purpose of a valve), and there is frequently a third in the outer end of the cylinder. All these valves open outwards from the receiver. The action of the pump, when arranged in this way, is exactly similar to the action of an ordinary well-pump, with air as fluid instead of water. The air-pump was invented about 1654 by Otto von Guericke, a magistrate of Magdeburg, and a man who devoted great attention to various problems in pneumatics. See PNEUMATICS.

AIR-PUMP, in steam-engines, is the pump which draws the condensed steam, along with the air which is always mixed with it, and also condensing water (except where a surface condenser is used), away from the condenser, and discharges into the hot well. See STEAM-ENGINE.

AIR, or **ASBEN**, a country of central Africa, lying between 15° and 19° N. lat. and 6° and 10° E. long. The northern and best known portion of this region is of a very diversified character. It has numerous mountain ranges, some of which rise to a height of 5000 feet, with richly-wooded hollows and extensive plains interspersed. The mimosa, the dum-palm, and the date are abundant; and the valleys are covered with the exuberant vegetation of the tropics. Some of the plains afford good pasturage for camels, asses, goats, and cattle; others are desert table-lands. In the less frequented districts wild animals abound, notably the lion and gazelle. The country generally is of sandstone or granite formation, with occasional trachyte and basaltic ranges. There are no permanent rivers; but during the rainy season, from August to October, very heavy floods convert the water-courses in the hollows of the mountains into broad and rapid streams. Numerous wells supply the wants of the people and their cattle. Agades is the capital.

AIRAY, HENRY, D.D. This celebrated Puritan president of Queen's College, Oxford, was born at Kentmere, near Windermere, but no record remains of the date of either birth or baptism. Anthony à Wood names Westmoreland as his birthplace. In the well-known *Life of Bernard Gilpin* it is told that when he was making preparations for martyrdom, he "received the account with great composure; and immediately after called up *William Airay*, a favorite domestic, who had long served him as his almoner and steward." From the great kindness shown to Airay by Gilpin, and from the vicinity of Kentmere to the Rectory, it

does not appear to be hazarding too much to assume that this William Airay was his father, and that the family tradition is right in assigning Kentmere, not Barton or Wilford, as his birthplace. He died on 6th October 1616. His character as a man, preacher, divine, and as an important ruler in the university, will be found portrayed in the Epistle by Potter, prefixed to the *Commentary*. He must have been a fine specimen of the more cultured Puritans—possessed of a robust common-sense in admirable contrast with some of his contemporaries.

AIRD, THOMAS, born in Scotland in 1802; died April 25, 1876. He wrote for the Scottish press and was the author of considerable poetry, principally of a domestic character.

AIRDRIE, a parliamentary and municipal burgh and market-town of Scotland, in the parish of New Monkland, Lanarkshire, eleven miles east of Glasgow and thirty-two west of Edinburgh. The high road between these cities passes through Airdrie, forming its principal street, from which others diverge at right angles. It is well built, paved, and lighted with gas, but it contains little that is beautiful or attractive. Population 1900, about 22,000.

AIRE, an English river which rises in the West Riding of Yorkshire and pursues a southeasterly course through the populous "clothing district" of which Leeds is the capital.

AIRE, a fortified town of France, on the river Lys, in the department of Pas-de-Calais, ten miles southeast of St. Omer. Population, 8,803.

AIRE, a town in the south of France, in the department of Landes, on the left bank of the Adour, fourteen miles south-southeast of St. Sever. Population about 4,000.

AISLE, sometimes written **ISLE**, **YLE** and **ALLEY** (Lat. and Ital. *Ala*, a wing; Fr. *Aile*, *Bas côté*; Ger. *Seitenschiff*, *Seitenchor*), in its primary sense, the wing of a house, but generally used to describe the alleys or passages at the sides of the naves and choirs of churches. In reckoning their number, the nave is usually counted. Thus a nave with an aisle on each side is generally called a three-aisled church; if with two aisles on each side, a five-aisled church. In England there are many churches with one side-aisle only; but there is only one cathedral with five aisles, that at Chichester. There are, however, very many such on the Continent, the most celebrated of which are at Milan and Amiens.

AISNE, a river of France, flowing 150 miles through the departments of Marne, Ardennes, Aisne, and Oise, and falling into the river Oise above Compiègne.

AISNE, a frontier department in the northeast of France, bounded on the north by the department of Nord and the kingdom of Belgium, on the east by the department of Ardennes, on the southeast by that of Marne, on the south by that of Seine-et-Marne, on the west by those of Oise and Somme; extending at the widest points seventy-five miles from north to south, and fifty-three from east to west, with an area of 2,838 square miles. Population, (1901), 534,204.

AITON, WILLIAM (1731–1793), an eminent botanist and gardener, was born near Hamilton, in Scotland. Having been regularly trained to the profession of a gardener, he traveled to England in the year 1754, where he became assistant to Philip Miller, then superintendent of the physic garden at Chelsea. He published several works on botany.

AITZEMA, LEON VAN, Dutch historian and statesman, was born at Doornum, in Friesland, November 17, 1600, and died at the Hague, February 23, 1669. In his youth he published a volume of Latin poems under the title of *Poemata Juvenilia*.

AIX, an ancient city of France, the chief town of the *arrondissement* of the same name, in the department of the Bouches-du-Rhône. It was the *Aqua Sextie* of the Romans, and between this and *Arelate* (Arles) is the field on which Marius gained his great victory over the Teutons. Under the counts of Provence, Aix became celebrated as a seat of learning; and it still retains many relics of its former splendor, and is distinguished by the number and excellence of its literary institutions. Population about 24,200.

AIX, or **AIX-LE-BAINS**, a town of France, in the department of Savoie, near Lake Bourget, 8 miles north of Chambéry. Population, 4430.

AIX-LA-CHAPELLE, the German **AACHEN**, the capital of a district of the same name in Rhenish Prussia, situated near the Wurm, a tributary of the Meuse, in a pleasant and fertile valley about 40 miles west of Cologne, with which it is connected by railway. It is well built, and is enclosed by ramparts that have been converted into promenades, and its appearance is rather that of a prosperous modern town than of an ancient city full of historical associations. Its town-house, built in 1353 on the ruins of Charlemagne's palace, contains the magnificent coronation hall of the German emperors, 162 feet long by 60 feet wide, and a fountain, with a statue of Charlemagne, which was erected in 1620. The chief manufactures of Aix-la-Chapelle are woollen cloths, stockings, shawls, silks, leather, glass, needles, pins, machines, general ironmongery, carriages, beer, brandy, tobacco, and chemicals. There is a good trade in these articles, not only with Germany and other continental countries, but also, in the case of cloth especially, with the United States of America. Charlemagne, who perhaps was born and certainly died in the town, made it the second city of his empire and the capital of his dominions north of the Alps. From 813 to 1531 the emperors of Germany were crowned at Aix-la-Chapelle, which during that period became one of the most important free imperial cities, although it was ravaged by the Normans in 851, and again in 882. By the removal of the coronations to Frankfurt, Aix-la-Chapelle lost its leading position in Germany, and its internal prosperity was much injured by a disastrous fire in 1656. During the revolution it for a time belonged to France, but in 1815 it was ceded to Prussia, and has now become one of the chief seats of commerce in that kingdom. Population of Aix-la-Chapelle (Aachen), 1900, 135,235.

AIX-LA-CHAPELLE, *Congresses and Treaties of*. The first congress of Aix-la-Chapelle concerned the succession of Maria Theresa to the empire. It was held in 1748, and resulted in the treaty of Aix-la-Chapelle, signed in the same year, by which Maria Theresa was left in possession of most of her hereditary dominions, the chief exception being Silesia, which was ceded to Prussia. The second congress, held in 1818, resulted in the convention of Aix-la-Chapelle. The object of this congress was the regulation of the affairs of Europe, especially of France, after the war.

AJACCIO, the chief town of Corsica, one of the departments of France. It is a seaport, situated on the west coast of the island. The harbor is commodious, and sheltered on all sides save the south-west. It is the seat of a bishop and a court of justice, and has a commercial college. Wine, fruits, and olive oil are the chief articles of trade; and anchovy and coral fisheries are extensively prosecuted along the coast. Ajaccio is celebrated as the birthplace of Napoleon Bonaparte. The house where he was born (15th August 1769) is still standing in good preservation. Population about 25,000.

AJAN, a tract which forms the eastern horn of Africa.

The coast towards the south is low and sandy, but northward, near Cape D'Orfui, it becomes high and mountainous, with some fertile valleys interspersed. The land for the most part is barren. The inhabitants carry on a trade with the Arabs in ivory and gum, and the country possesses an excellent breed of horses.

AJAX, the son of Telamon. In Greek legend Ajax represents throughout only physical qualities, like Hercules. The child Ajax was born at the prayer of Hercules in behalf of his friend Telamon. Hercules was present at the birth of the infant, and by wrapping it in his lion's skin made it invulnerable, except in the armpit.

AJAX OILEUS, or the **LESSER AJAX**, was a son of the King of Locri, whose subjects he led before Troy, contributing a contingent of forty ships. In boldness he was in the first rank among the Greeks there, equal to make a stand against Hector, and swift of foot next to Achilles. But, compared with the other leaders, he is impatient and overbearing.

AJEHO, or **A-SHE-HOH**, also called **ALCHUKU**, a considerable and rapidly increasing city of Manchuria, 30 miles south of the river Soongari, and about 120 north of Kerin. The country around is very fertile, producing in abundance various kinds of grain, besides pulse and opium. The population of the district consists entirely of Chinese immigrants, who are engaged in the reclamation and cultivation of the soil, which is given to them at a nominal price. In the shops quantities of porcelain and other ornamental articles exposed for sale indicate its growing wealth. The population is about 40,000.

AJMİR, a district and town of British India, in Rājputānā. The population in 1901 was returned at 476,330; of whom 363,539, or 85 per cent., were Hindus, and the remainder chiefly Mahometans. The eastern portion of the district is generally flat, broken only by gentle undulations, but the north-western parts are intersected by the great **ARAVALLI** range. Ajmīr is almost totally devoid of rivers, the *Bandās* being the only stream which can be dignified with that name, and it only touches the south-eastern boundary of the district so as to irrigate the *Parganā* of Samur. The principal products of the district are wheat, barley, rice, sugar-cane, peas, *bajārā*, maize oil (oil-seed), tobacco and cotton. With the exception of woollen blankets, turbans, &c., manufactures can be scarcely said to exist in Ajmīr. Salt is made in a rude method at Rāmsur, from the saline exudations of the soil, to the extent of 3000 cwt. per annum. After supplying local wants, the surplus is exported towards *Mālwa* and *Sāgar*. The principal trade is in wool, cotton, opium, printed cloths, and tobacco. Oil is also a profitable article of trade. The domestic animals are sheep, horses, bullocks, and goats. Cattle, and especially bullocks, are much valued, but are very scarce, owing partly to the want of sufficient pasturage and partly to frequent droughts. The imperial revenue obtained from the district in 1889 amounted to \$360,000, exclusive of local funds raised by a road, tank, and postal cess.

AJMIR CITY, the capital of Ajmīr district, is situated in a picturesque and fertile valley surrounded by mountains. The town is partly built on the lower slope of the *Tāgāgarh* hill, and is surrounded by a stone wall with five handsome gates. To the north of the city is a large artificial lake called the *Anasāgar*, whence the water supply of the place is derived. The town is clean, and possesses several handsome streets, the dwellings of the better class being large and well built. The population in 1901 numbered 75,759. The city trade chiefly consists of salt and opium. Oilmaking is also a profitable branch of trade. Cotton cloths are manu-

factured to some extent, for the dyeing of which the city has attained a high reputation. The Ajmir college, affiliated to the Calcutta university, had 400 pupils in 1887. The college buildings being inadequate to this number of pupils, the foundation-stone of a new structure was laid on the 17th of February, 1888. The city is a station of a Scotch Presbyterian mission.

AJURUOCA, a town of Brazil, in the province of Minat Geraes, 117 miles N. of Rio de Janeiro. It is situated on the Ajuruoca river, which is here crossed by a bridge. The people are chiefly engaged in agriculture, and in rearing animals for the markets of Rio. The land is fertile and produces millet, mandioca, coffee, sugar-cane and tobacco. The population of the town and district is 12,000.

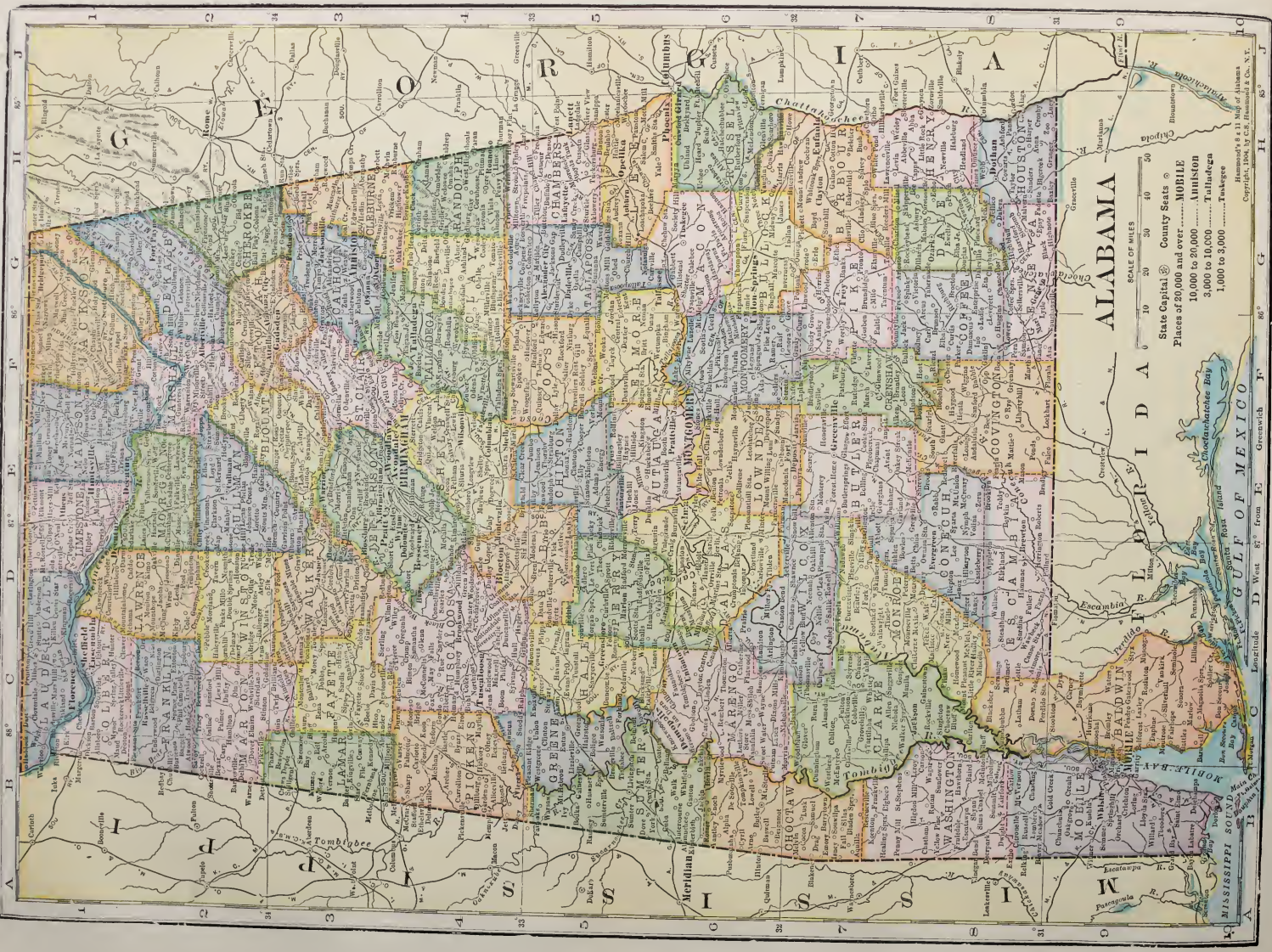
AKABAH, THE GULF OF. It penetrates into Arabia Petrea in a N.N.E. direction, a distance of 100 miles, and its breadth varies from 12 to 17 miles; its navigation is dangerous on account of its numerous coral reefs, and the frequent squalls which sweep down from the adjacent mountains, many of which rise perpendicularly to a height of 2000 feet. The only well-sheltered harbor is that called Golden Port, situated on its western shores about 33 miles from the entrance, and 29 miles E. of Mount Sinai. In the vicinity of the village there are extensive date groves; and there is abundance of good water, fruit and vegetables. It is supposed to occupy the site of the *Elath* of Scripture, which in remote ages carried on an extensive commerce.

AKBAR, AKHBAR, or AKBAR, JELLALADIN MOHAMMED, one of the greatest and wisest of the Moghul emperors, was born at Amerkote in Sindh on the 14th October 1542. Akbar succeeded his father, Humayun, in 1556, under the regency of Bahram Khan, a Turkoman noble, whose energy in repelling pretenders to the throne, and severity in maintaining the discipline of the army, tended greatly to the consolidation of the newly-recovered empire. Bahram, however, was naturally despotic and cruel; and when order was somewhat restored, Akbar found it necessary to take the reins of government into his own hands, which he did by a proclamation issued in March 1560. When Akbar ascended the throne, only a small portion of what had formerly been comprised within the Moghul empire owned his authority, and he devoted himself with great determination and marvellous success to the recovery of the revolted provinces. He tried by every means to develop and encourage commerce; he had the land accurately measured for the purpose of rightly adjusting taxation; he gave the strictest instructions to prevent extortion on the part of the tax-gatherers, and in many other respects displayed an enlightened and equitable policy. Thus it happened that, in the fortieth year of Akbar's reign, the empire had more than regained all that it had lost, the recovered provinces being reduced, not to subjection only as before, but to a great degree of peace, order, and contentment. Akbar's method of dealing with what must always be the chief difficulty of one who has to rule widely diverse races, affords perhaps the crowning evidence of his wisdom and moderation. In religion he was at first a Mussulman, but the intolerant exclusiveness of that creed was quite foreign to his character. He conciliated the Hindoos by giving them freedom of worship; while at the same time he strictly prohibited certain barbarous Brahminical practices, such as trial by ordeal and the burning of widows against their will. He also abolished all taxes upon pilgrims as an interference with the liberty of worship, and the capitation tax upon Hindoos, probably upon similar grounds. Matters like these gained for him during his lifetime the title of "Guardian of

Mankind," and caused him to be held up as a model to Indian princes of later times, who in the matter of religious toleration have only too seldom followed his example. Akbar was a munificent patron of literature. He established schools throughout his empire for the education of Hindoos as well as Moslems, and he gathered around him many men of literary talent, among whom may be mentioned the brothers Feizi and Abulfazl. It is also said that Akbar employed Jerome Xavier, a Jesuit missionary, to translate the four Gospels into Persian. The closing years of Akbar's reign were rendered very unhappy by the misconduct of his sons. Two of them died in youth, the victims of intemperance; and the third, Selim, afterwards the emperor Jehanghir, was frequently in rebellion against his father. He died at Agra on the 13th October 1605. His body was deposited in a magnificent mausoleum at Sicandra, near Agra.

AKEN, or AKEN, a town in Prussian Saxony, situated on the Elbe, 25 miles E.S.E. of Magdeburg, close to the frontiers of Anhalt. It has manufactures of cloth, leather, chemicals, and optical instruments; large quantities of beetroot sugar are produced in the neighborhood. Population (1900), 7,400.

AKENSIDE, MARK. Like young Henry Kirke White, the poet of the *Pleasures of Imagination* was the son of a butcher. He was born at Newcastle-on-Tyne on November 9th, 1721. In his sixteenth year he sent to the *Gentleman's Magazine* a copy of verses entitled "The Virtuoso." Sylvanus Urban graciously printed the poem; but the old gentleman was not difficult to please. In his nineteenth year, being intended for the clerical profession, he proceeded to the university of Edinburgh; but within one session, like many others, he changed his purpose, and transferred his name from the theological to the medical classes. On his change he honorably returned certain moneys which his fellow Presbyterians had advanced towards his theological education. He attended the university for only two years. Some of his minor poems belong to this period, such as his Ode "for the Winter Solstice," the elegy called "Love," and the verses "to Cordelia." In the summer or autumn of 1743 Dodsley carried with him to Pope at Twickenham a MS. for which the writer asked £120. The oracle of Twickenham having read the poem, counselled the publisher to make no niggardly offer, because "this was no every-day writer." The MS. was the *Pleasures of Imagination*, which Dodsley published in 1744. In his twenty-third year the author, like Byron, awoke to find himself famous. He went to Leyden, and there pursued his medical studies with ardor. He obtained the degree of M.D., May 16th, 1744; his inaugural dissertation describing the formation and growth of the human fetus with original observation and acuteness. He now returned to England. He chose Northampton as the place wherein he should commence practice. It was an unfortunate selection. At Northampton Akenside wrote his "Epistle to Curio," which Lord Macaulay pronounced his best production, as "indicating powers of elevated satire, which, if diligently cultivated, might have disputed the pre-eminence of Dryden." Not succeeding in his profession at Northampton, he removed. In three years he left Hampstead for London. He set up in Bloomsbury Square in a "fine house," and with an annuity of £300. In 1753 the university of Cambridge bestowed on him the degree of doctor of medicine. In 1754 he was elected a fellow of the College of Physicians. In 1765-6 he was working upon the revised and enlarged copy of the *Pleasures of Imagination*. His fame was widening professionally and poetically, when a putrid fever carried him off suddenly on June 23d, 1770.



ALABAMA

State Capital County Seats
Places of 20,000 and over **MOBILE**
10,000 to 20,000 **ANNISTON**
3,000 to 10,000 **TALLADEGA**
1,000 to 3,000 **PAWSHOG**

SCALE OF MILES
0 10 20 30 40 50

Hemond's & H. 11 July of Alabama
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AKERS, BENJAMIN PAUL, born in Maine, July 10, 1825; died in Philadelphia, May 21, 1861. He became a sculptor in Boston, and visited Italy, where he executed his best-known works, *Una and the Lion*, and *The Dead Pearl Diver*.

AKKA, a tribe of dwarfs in Central Africa, first discovered by Schweinfurth in 1874, and described by Junker, who visited them in 1882. They average less than five feet in height. They are timid and difficult of approach, and shun strangers.

AKOLÁ, a district and city of British India. The total area of the district contains about 2,697½ square miles, or 1,726,625 acres. The population of the district numbers about 550,000 souls, made up of various races—Hindus, Mahometans, aborigines, Christians, Parsees and Jews being the chief representatives.

The principal manufacture of the district is the weaving of cotton. Carpets and coarse cloths are woven in almost every village, with turbans at Bálápúr, and silk cloths for native women at Akolá and in the larger towns. The principal agricultural products are as follows: Cotton, rice, Indian corn, indigo, oil, seeds, wheat, linseed, peas, tobacco and mustard.

AKOLÁ TOWN, the headquarters of the district of the same name, and also of the west Berar division of the Haidarábád assigned territory, is situated on the Nágpúr extension of the Great Indian peninsular railway. A detachment of infantry is stationed at the town. Population in 1901, 24,006.

AKRON, a flourishing city of Ohio, the capital of Summit county, is situated at the junction of two canals and several railroads, 40 miles southeast of Cleveland, and 246 northeast of Cincinnati. The city lies on a high level, being about 400 feet above Lake Erie. It is well built, and the population and prosperity of the community are daily increasing. Among the public buildings may be noticed the county jail and the public schools, the latter of which are unsurpassed in any city of equal size in the Union. In addition to the common school system the city has the advantage of a college (Buchtel) of high standing. It also has a public library of 60,000 volumes. The wants of the religious community are supplied by over twenty churches. The streets are lighted by electricity and the houses by both gas and the former agent. An efficient electrical street railway system, twenty miles in length, furnishes passenger transportation. An excellent fire department is maintained at a cost annually of about \$60,500, while the police department, consisting of forty-six men, costs about \$50,000. The city receipts for the fiscal year 1901-02, from all sources were \$499,458.87, while the expenditures for the same period were \$494,322.53. The bonded indebtedness of the city, in 1902, was \$527,700. The city has an efficient municipal administration consisting of mayor and council, together with the usual department officers. There is some water-power here, which has been utilized to a limited extent. The banking and telegraph facilities of the city are good. Population (1900 census), 42,728.

AK-SU, a town of Chinese Turkestan. It has a flourishing trade, and is resorted to for purposes of commerce by caravans from all parts of Central Asia. There are some cotton manufactures; and the place is celebrated for its richly-ornamented saddlery made from deer-skin. Population, 30,000.

AKYAB, a district and city within the Arákán division of British Burmah. In 1871 the frontier of hill tracts of the district were placed under a special administration, with a view to the better government of the wild tribes which inhabit them. The district passed into the hands of the British at the close of the first Burmese war of 1825. Population, 359,706.

AKYAB, TOWN and PORT, is the chief town of the district of the same name, and the most flourishing city of the Arákán division. Population (1889), 26,000. It has connection with Calcutta by steamer. The principal export is rice.

ALABAMA, one of the Southern States of the North American Union. Its length is 330 miles, average breadth 154, and area 51,540 square miles. The Alleghany range stretches into the northern portion of the State, but the elevation is nowhere great. The Alabama is the chief river of the State. It is formed by the junction of the Coosa and the Talapoosa, which unite about 10 miles above the city of Montgomery. Forty-five miles above Mobile the Alabama is joined by the Tombigbee, and from that point is known as the Mobile River. It is navigable from Mobile to Wetumpka, on the Coosa, some 460 miles. The Tombigbee is navigable to Columbus, and the Black Warrior, one of its chief tributaries, to Tuscaloosa. The Tennessee flows through the northern portion of the State, and the Chattahoochee forms part of its eastern boundary. The climate of Alabama is semi-tropical. The temperature ranges from 82° to 18° Fahr. in winter, and in summer from 105° to 60°; the mean temperature for the year being a little over 60°. The average severity of the winter months is considered to have increased—a result due, it is said, mainly to the felling of the forests, which gives more unrestricted scope to the cold northwest winds from the Rocky Mountains.

Alabama possesses a rich soil of varied character, and produces corn and cotton in abundance. Of the former there is an average crop of 35,000,000 bushels, and of the latter nearly 1,000,000 bales are annually produced. Wheat, oats, and hay also form important articles of agricultural production. The State is heavily timbered, especially in the southern tier of counties.

The "Piney Woods" also afford a large supply of naval stores. Shipments of cotton are made from Mobile, and through Savannah, Ga., New Orleans, and Charleston, S. C. Rice and sugar-cane, sweet potatoes, and all kinds of vegetables and fruits are abundant, and some tobacco is grown in the north. There is an abundant rainfall, aggregating fifty to fifty-four inches per annum, and well distributed throughout the seasons. Much attention is given to stock raising. The returns in 1900 of live stock show 152,643 horses; 192,070 mules, 279,263 milch cows, 520,471 oxen and other cattle, 229,298 sheep, and over 1,423,329 hogs. The chief cotton-growing counties are Dallas, Montgomery, Lowndes, Marengo, and Bullock.

The abundant mineral resources of Alabama were practically unknown until a very few years ago, but have been developed wonderfully during the last decade. Coal is found in vast deposits, side by side with beds of limestone and iron ore of enormous extent. In the valleys of the Tennessee and upper Alabama rivers, such enterprising cities as BIRMINGHAM (*q. v.*), BESSEMER (*q. v.*), Sheffield, Roanoke, Huntsville, Decatur, and others, ranking with the most energetic and rapidly-growing mining and manufacturing cities of the North, have sprung from nothing or from petty villages. It is claimed that pig iron can be manufactured more cheaply in Alabama than anywhere else in the Union. There are large manufactures of cotton goods, and many varied industries have been introduced. The railway system has been rapidly extended since the war. In 1900 there were 4,240 miles of completed railroad, assessed for purposes of State taxation at over \$40,000,000.

The population of Alabama, 1,513,017 in 1890, increased 20.8 per cent. during the next decade, and the census of 1900 returns it at 1,828,697. There are over 827,000 colored people in the State. The chief

towns are Montgomery, the capital, population (1900), 39,346; Mobile, 38,469; Birmingham, 38,415; Selma, Anniston, and Huntsville. Mobile is the only seaport.

Alabama returns nine members to congress. The State officers are governor, secretary of state, treasurer, auditor, attorney-general, superintendent of public instruction, and commissioner of agriculture, and there are commissioners of education and agriculture. On September 30, 1899, the year's receipts amounted to \$2,819,188. The bonded debt on Oct. 1, 1900, was \$9,357,600. In 1901, Alabama adopted a new constitution, which gives the State a lieutenant-governor as well as a governor, and makes their terms of office, and that of the legislature, four years. The latter will hold its sessions once in four years, instead of biennially. The limit of State taxation is by the new constitution reduced from 75c. to 65c. on every \$100 worth of property, while the power of counties and towns to contract indebtedness is restricted.

There is a good school system, supplemented by State-aided universities, and normal and training schools, and a college of technology. In 1900, the school population was 641,000; pupils enrolled, 433,733; average attendance, 341,138; number of teachers, 7,303; cost of education, derived from school and poll tax, and legislative appropriation, exceeds \$1,000,000. Besides the elementary schools, Alabama has 54 high schools, with 3,066 students and 151 teachers, 5 public normal schools, with 817 students and 51 teachers. The school of technology has about 360 students, and 30 professors and instructors. Thirty cents of every sixty-five cents collected for State taxes go to the public school fund.

Alabama was first explored by the Spaniards under De Soto, in 1541. It was originally included within the domain of Georgia, but in 1802 became part of the Territory of Mississippi. Early in this century the settlers met with considerable trouble at the hands of the Creek Indians, but in 1813 an expedition was sent against them, and Gen. Andrew Jackson completely defeated them at the battle of Horseshoe Bend. The State was admitted to the Union in 1819, having been for two years a Territory under its present name. Mobile was founded by the French in 1711. Prior to the war Alabama ranked for a time first among the cotton-producing States, and grew rapidly in wealth. Early in 1861 an ordinance of secession was adopted, and Montgomery was made the temporary capital of the Confederacy. The State was the theatre of war in 1862, and in 1864 Mobile was the scene of a naval battle and her forts were silenced by Farragut. In 1865 Mobile, Selma, and Montgomery were taken by Federal troops, and a provisional governor was appointed by President Johnson later in that year. In 1868 (and again in 1901) a new constitution was adopted, and the State was readmitted to representation in congress.

ALABAMA CLAIMS. The extended negotiations growing out of the claims so called, the treaty which resulted therefrom between the United States and Great Britain, and the arbitration at Geneva by whose findings the provisions of the treaty were executed, constitute the most important piece of diplomacy in which this country ever engaged. The claims were made upon England by the United States government in behalf of itself and certain citizens, on account of depredations committed by certain vessels which were fitted out and sailed from British ports during the war of secession in the United States.

The language of the treaty providing for an adjustment of these claims was broad, and it was concluded at Washington, May 8, 1871. It was due to a change in the attitude of the British statesmen which had come about after the close of the war, they having previously insisted that their power to prevent the equipment of hostile vessels in their waters was limited by the language of their statute. Under this

statute Lord Russell declared that the executive could not act, and that all proceedings must be judicial, and it was because of this attitude that the acts complained of by the United States were not at the time prevented and the claims afterwards accrued.

Without going into detail as to the positions taken by the parties to the controversy in the course of the proceedings before the arbitrators at Geneva, it may be said that the result turned upon the old question so often argued in courts of justice here and in England, as to the true meaning and application of the words "due diligence." The final decision of the commissioners was given Sept. 14, 1871. It was unanimously in favor of Great Britain in respect to the vessels named the *Georgia*, *Sumter*, *Nashville*, *Tallahassee*, *Chickamauga*, and *Retribution*, by a vote of three to two. They all decided that Great Britain was liable for the fitting out and escape of the *Alabama*, and also the *Florida*, in the latter case Sir Alex. Cockburn dissenting. There were some further particular findings, the purport of the award being that these general principles must govern such cases. "Due diligence should be exercised by neutral governments in exact proportion to the risks to which either one of the belligerents may be exposed by failure to fulfill the obligations of neutrality on their part." "The government of Great Britain cannot justify itself for its failure in due diligence on the plea of the insufficiency of the legal means of action which it possessed."

Earlier in the proceedings the claim of the United States for indirect damages had been thrown out by the commission as not constituting proper matter for consideration. The commission likewise decided against any claims by the United States for national or indirect losses, and entirely restricted its judgment to compensation of American citizens for losses incurred. It awarded the sum of \$15,500,000.

ALABASTER, a name properly restricted to the fine massive variety of gypsum, or sulphate of lime, which is used in the manufacture of ornamental vases, statuettes, clock-frames, etc. When pure it is of a brilliant pearly-white luster, so very soft as to be easily scratched by the nail, and is soluble to a slight extent in water.

ALABASTER, WILLIAM, D.D., poet and scholar. He was born at Hadleigh, Suffolk, England, about 1567, was educated at Westminster School, and went thence to Trinity College, Cambridge. His best known verse is a Latin tragedy called *Roxana*; this is praised by Fuller, and is regarded by Dr. Johnson as the only Latin verse in England worthy to be named previous to Milton. Alabaster died about 1640.

ALAGOAS, a maritime province of Brazil, district of Pernambuco. It embraces an area of 22,580 square miles. The country, particularly in the northwest, is very mountainous, but at the same time richly wooded. The chief articles of produce and export are sugar-cane, rice, cotton, hides, and rosewood. Tropical fruits of all kinds are produced in abundance, and the forests, besides admirable timber, yield various dyes and drugs. The people are chiefly engaged in agriculture, and there are no manufactures of importance. The population of the province is 511,440. The town of ALAGOAS, formerly the capital of the province, is situated on Lake Manguaba. It has declined considerably since the transfer of the local government to Maceio. Population, including district, 40,000.

ALAIN DE LILLE (ALANUS AB INSULIS), theologian and ecclesiastic, born at Lille or Ryssel about the year 1114. All that can be said with certainty is that he was a Cistercian monk. It is probable that he passed a

great part of his life in England, though he ended his days in the abbey of Cîteaux. His works are very numerous, the most important of them being entitled *Anticlaudianus*, *sive de Officio Viri Boni et Perfecti*.

ALAIS, a flourishing town of France, in the department of the Gard, on the right bank of the Gardon, at the foot of the Cevennes. In the 17th century it was a stronghold of French Protestants, and was taken by Louis XIII. in 1629. Population, 17,598.

ALAJUELA, a city in the state of Costa Rica, Central America. It is a place of considerable trade, and is connected by a mule road with the port of Puntas Arenas, the only good harbor possessed by Costa Rica on the Pacific Ocean. The sugar-cane is cultivated in the neighborhood. Population, 12,575.

ALAMANNI, or ALEMANNI, LUIGI, an Italian statesman and poet, was born at Florence in 1495. He was a favorite with Francis I. of France, who sent him as ambassador to Charles V., after the peace of Crespi, in 1544.

After the death of Francis, Alamanni enjoyed the confidence of his successor Henry II., and in 1551 was sent by him as his ambassador to Genoa. He died at Amboise in 1556. He wrote a large number of poems, distinguished by the purity and excellence of their style.

ALAMEDA, a city of Alameda county, Cal., occupies a peninsula, about 2,300 acres in extent, on the east side of San Francisco Bay, eight miles from the city of San Francisco, and is accounted one of the best situated towns in that portion of the State. The streets are broad and shaded with magnificent live oaks, while the structures in both the business and residence portion are commodious and handsomely appointed. It contains six churches, one weekly and one semi-weekly paper, schools, halls, etc., lumber and oil mills, rope factories, and other works. It has street railways, and is connected with Oakland and San Francisco by rail and water. Population, (1900), 16,464.

ALAMO, THE, the name of a castle or fortress in the city of San Antonio, Texas, in which occurred, during the war for Texan independence, the massacre of all its surviving garrison. The fortress, occupied by a devoted band of Texans, had held out for a considerable time against a vastly larger number of Mexicans under General Santa Aña, but was carried by storm at last, and all its occupants butchered—but one person, a female infant, escaping. Among the slain were David Crockett and Col. James Bowie.

ALAMOS, Los, a town of Mexico, in the state of Sinaloa; provisions are dear and water scarce. The surrounding district contains many rich silver mines. Of the population, amounting to about 10,000, a large proportion are employed in the mines.

ALAMOS DE BARRIENTOS, DON BALTHAZAR, a Spanish philologist, born at Medina del Campo, in Castile, about 1550. He died at the age of eighty-five.

ALAN, ALLEN, or ALLYN, WILLIAM (1532-94), cardinal, was born at Rossall in Lancashire. He studied at Oriel College, Oxford, and was appointed principal of St. Mary's Hall in 1556. Two years later he was made a canon of York; but being opposed to the Reformation, was forced to flee to Louvain on the accession of Elizabeth. He returned to England after a time, and for some years resided chiefly at Oxford; but his proselytising zeal being discovered, necessitated a second flight. The great aim of his life seems to have been to restore the papal supremacy in England. For this purpose he founded the college at Douay, and sent over the Jesuit priests trained there to his native land. He was, of course, a bitter enemy of Elizabeth, who expelled his emissaries, and even caused some of them to be put to death. He was one of the chief intriguers

in the Spanish plot which led to the fitting out of the Armada.

ALAND ISLANDS, an archipelago at the entrance to the Gulf of Bothnia. The group consists of nearly 300 islands, of which about 80 are inhabited, the remainder being desolate rocks. They formerly belonged to Sweden; and in the neighborhood the first victory of the Russian fleet over the Swedes was gained by Peter the Great in 1714. They finally passed into the possession of Russia in 1809. The inhabitants, amounting to about 16,000, are mostly of Swedish descent, and are hardy seamen and fishermen.

ALANI, a number of nomadic tribes of eastern origin, who spread themselves over Europe during the decline of the Roman empire. It is supposed that their first encounter with the Romans was during the Mithridatic war, when Pompey led an expedition into the Caucasus. In March 276 A. D. they received a decisive check in an attempt to make their way eastward into Persia, being defeated by the emperor Tacitus, who forced them to recross the Phasis. The race thereupon divided, some retiring to the east, while the great majority joined their conquerors in an invasion of the kingdom of the Goths. In 418, however, they were attacked and defeated by Wallia, king of the Visigoths, with whom they had quarrelled. Their king, Ataces, was slain in the battle, and they became subject to Gunderic, king of the Vandals, their national independence being lost. In 572 they were allied with the Armenians under King Seroes. In 1237 they were so completely subjugated by Batu-Khan that their very name disappears in subsequent history.

ALARCON, HERNANDO DE, a Spanish navigator of the 16th century, known only in connection with the expedition to the coast of California, of which he was leader. He set sail on the 9th of May 1540, with orders from the Spanish court to await at a certain point on the coast the arrival of an expedition by land under the command of Vasquez de Coronado. The junction was not effected, though Alarcon reached the appointed place and left letters, which were afterwards found by Diaz, another explorer. Alarcon was the first to determine with certainty that Lower California was a peninsula and not an island, as had been supposed.

ALARCON Y MENDOZA, JUAN RUIZ DE, one of the most distinguished Spanish dramatists, born at Tasco in Mexico about the close of the 16th century, was descended from a noble family belonging to Alarcon in Cuenca. In 1622 he had taken up his residence at Madrid, and in 1628 he was appointed to the office of *relator* (reporter) of the royal council of the Indies, which afforded him a competency. In the same year he published the first volume of his comedies, dedicating it to "the rabble" in a daringly contemptuous address. A further injustice was done him in the piracy of his works by other and better known authors than himself. To such an extent was this carried that Alarcon's reputation as a dramatist was almost extinct even before the close of his life, and it is only quite recently that it has been revived. The date of his death is given, on doubtful authority, as 1639. He is distinguished by the correctness of his language, the harmony of his verse, and the elevation of his sentiment.

ALARIC (*Al-ric*, i.e., All rich), a chief, and afterwards king of the Visigoths, was born of the noble family of Balti (*blatha*, bold). He first appears in history (394 A.D.) as a commander in the army of subjugated Goths whom the Emperor Theodosius employed in his war with Eugenius. On the death of Theodosius in 395 the Goths asserted their independence, and under the leadership of Alaric made an incursion from Thrace, where they had been located, into the Morea. Athens

yielded to them without resistance, and Alaric enriched himself with the movable treasures of the city. The Gothic chief was chosen king by his people, and accordingly about the year 400 A. D. he set out to invade the Empire of the West. Alaric marched upon Rome (408) by the Via Flaminia, and laid siege to the city. On coming to treat with him, the Romans found his demands so extravagant that they threatened a desperate resistance, to which Alaric made the well-known reply, "The closer hay is pressed, the easier is it mown." At last the barbarian was induced to retire by the promise of 5000 pounds of gold and 30,000 pounds of silver, besides other treasure. The respite, however, was but for a time. Honorius, who had left Rome for Ravenna, refused to ratify by treaty, certain conditions, moderate in themselves, on which Alaric firmly insisted, and the capital was again at the mercy of the enemy. With commendable forbearance, Alaric contented himself at first with taking possession of Ostia, from which he summoned the city to surrender, threatening the immediate destruction of the food stores in case of refusal. The terrified people at once opened their gates, and agreed that the conqueror should appoint another emperor in place of Honorius. Alaric's choice fell upon Attalus, the prefect of the city, who, though well received at first, soon proved himself thoroughly incompetent, and Honorius had to be restored. While the conferences as to the restoration were still being carried on at Ravenna, the treachery of Honorius occasioned yet another and more disastrous siege of Rome by the Goths. Sarus, a barbarian and a hereditary enemy of the house of Balti, was permitted by the emperor to attack the camp of the Goths and return in triumph to Ravenna. Alaric was naturally indignant, laid siege to Rome for the third time, and gained an entrance by the Salarian gate on the night of the 24th August 410. For six days the city was given over to the horrors of a pillage, which the humane orders of Alaric did but little to mitigate. On the 26th August Alaric withdrew his troops from Rome, and led them into southern Italy, which he ravaged for several months. Towards the close of the year, while engaged in the siege of Cosenza (*Cosenza*), he was seized with an illness which proved fatal after a very short duration. He was buried with his treasures in the bed of the river Busentinus, which was diverted from its channel for that purpose, and all the prisoners who were engaged in the work were put to death in order that the place of his sepulture might remain unknown.

ALARIC II., eighth king of the Goths in Spain, succeeded his father Euric or Evaric about 484. His dominions not only included the greater part of Spain, but extended into Gaul as far as the rivers Rhone and Loire. In religion Alaric was an Arian. Clovis, desiring to obtain the Gothic province in Gaul, found a pretext for war in the Arianism of Alaric. The intervention of Theodoric, king of the Ostrogoths and father-in-law of Alaric, proved unavailing. The two armies met in 507 at Voglade, near Poitiers, where the Goths were defeated, and their king, who took flight, was overtaken and slain by Clovis himself.

ALASCO, JOHN, a Polish nobleman, born in 1499, who travelled extensively in his youth, and during a residence in Zurich imbibed the doctrines of the reformation from Zwingli. At Basel in 1525 he had frequent intercourse with Erasmus, who held him in great esteem and bequeathed his library to him. Alasco died in 1560.

ALA-SHEHR, a city of Asiatic Turkey. The city occupies the site of the ancient *Philadelphia*, one of the "seven churches in Asia" of the Apocalypse.

Ala-Shehr has an active trade, and the population is about 18,000.

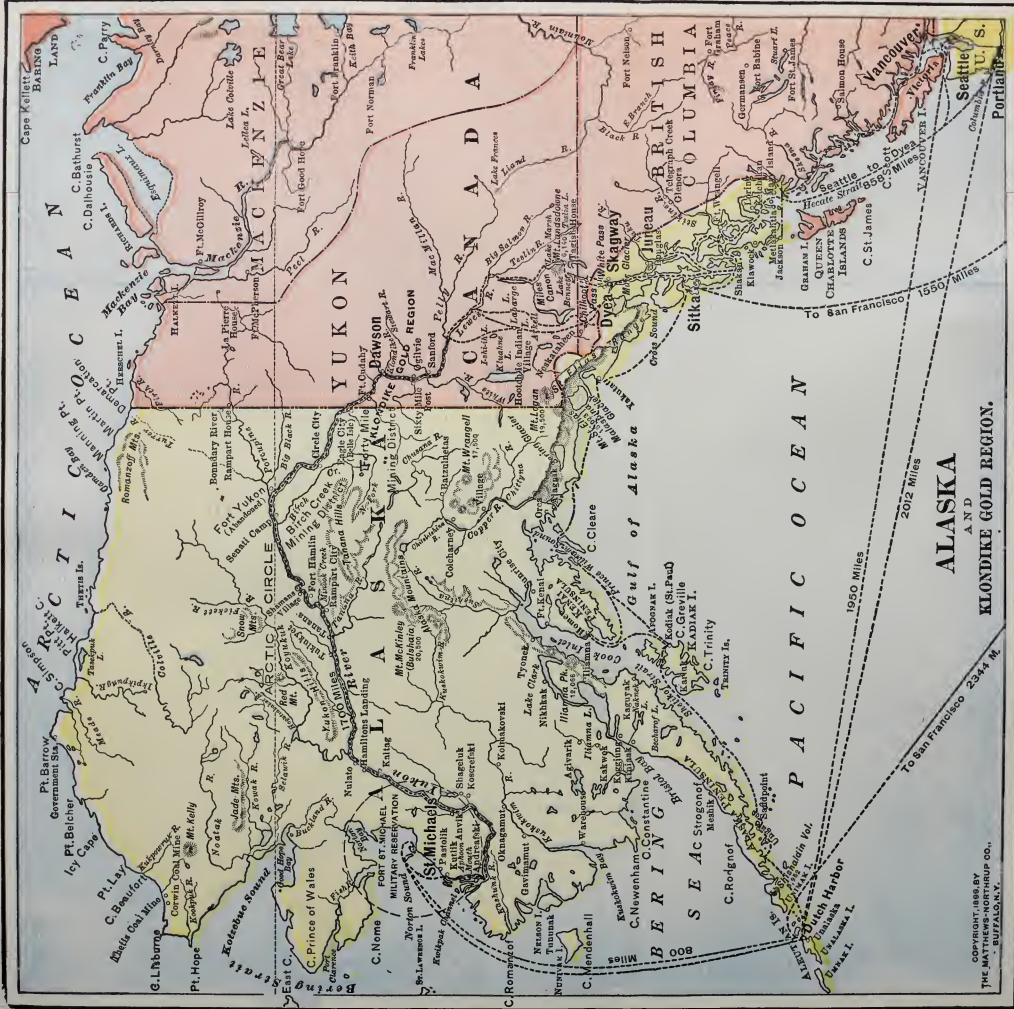
ALASKA, one of the territories of the United States, is situated on the northwestern coast of America, and, besides the mainland, comprises a great number of islands in the Pacific Ocean. The Arctic Ocean forms its northern boundary, while on the east lie the British possessions of the Northwest Provinces and British Columbia; the south and west are covered by the Pacific Ocean, Behring Sea and the Arctic Ocean. Its area is estimated at about 590,884 square miles, thus being equal in extent to Great Britain, Ireland, France and Spain. The northern portion of the territory consists of broken, mountainous lands, interspersed with numerous lakes and rivers, with a vast expanse of swamp lands. Owing to its high latitude the climate of this portion of the country is excessively severe in winter, while the summer season is rendered unendurable from the vast clouds of insects and the volume of effluvia given out by the thaw. The river system of this portion of the territory is on a grand scale; the Yukon river and its tributaries discharging, it is claimed, more water than the Mississippi into the sea. The population is varied and consists of the Esquimaux in the north, and the Athabascans (North American Indians) in the south and southwest. The chief resources of the inhabitants are the fur trade and fisheries. Commerce is inconsiderable, and is almost entirely obstructed, owing to the lack of internal transportation and the dearth of good harbors and navigable waters on the coast.

The Aleutian Islands and a portion of the peninsula of Alaska form a second section or division of the territory. The topography of the country is distinctively mountainous and volcanic. The population in this portion of the country is very sparse and the characteristics of the inhabitants seem to be rather Asiatic than American; their principal industry is the seal fishery—the Pribyloff Islands in Behring Sea being the most productive seal fishery in the world at the present time. Still another section of the country, with distinctive characteristics, is found in the southeastern portion of the territory. This region comprises a narrow strip of mainland, together with the Alexander Archipelago, and is of a glacial character. The climate is very mild, in view of the high latitude, but the warm current of the ocean on the contiguous coast induces excessive rains. The country is heavily timbered, and the waters abound in fish of almost every variety. The population here is very scant and consists of many diverse races—Indians, Americans, Russians, etc. The mineral productions are gold, in limited quantities, and coal of a very poor quality. Alaska, owing to the poor quality of its soil, can never be an agricultural country, and the broken rocky nature of its topography will ever prevent the domestication of a large population. Sheep cannot be raised on account of the excessive moisture of the climate, and only a few cattle are at present to be found. But few vegetables and potatoes are grown.

The fauna of the country consists mostly of fur-bearing animals, but owing to the climate, with but few exceptions their furs are regarded as inferior to those of other portions of Arctic America. The most common animals are reindeer, moose, Rocky Mountain sheep, bears, wolves, foxes, rats, ermines, minks, sables, lynxes, beavers, wolverines, squirrels, hares, porcupines, marmots, otters, walruses, and seals of various kinds. Among the most important food fishes are the cod, halibut, herring, and salmon of various species.

The principal settlements are small and nearly all of them are on the coast. Sitka is the capital, and the





ALASKA

AND
KLONDIKE GOLD REGION.

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other places, which can be called towns are Fort Wrangell, Skagway, and Juneau.

The population of the country in 1900 was estimated at 63,592, the white population having of late rapidly increased, owing to the attraction of the various industries. Nome City has the largest population.

The northwest coast of this part of America was discovered and explored by a Russian expedition under Behring in 1741; and at subsequent periods settlements were made by the Russians at various places, chiefly for the prosecution of the fur trade. In 1799 the territory was granted to a Russo-American fur company by the Emperor Paul VIII., and in 1839 the charter of the company was renewed. New Archangel was the principal settlement, but the company had about forty stations. They exported annually 25,000 skins of the seal, sea-otter, beaver, etc., besides about 20,000 sea-horse teeth. The privileges of the company expired in 1863; and in 1867 the whole Russian possessions in America were ceded to the United States for a money payment of \$7,200,000. The treaty was signed on March 30, and ratified on June 20, 1867; and on October 9th following, the possession of the country was formally made over to a military force of the United States at New Archangel.

ALATRI. A town of Italy. Population of commune, 11,370.

ALAVA, one of the Basque provinces, in the north of Spain, with an area of 1,205 square miles. The surface of Alava is very mountainous, especially on the north, where a part of the Pyrenees forms its natural boundary. The soil in the valleys is fertile, yielding wheat, barley, maize, flax, hemp, and fruits. Oil, and a poor kind of wine called *chacoli*, are also produced. Population in over 100,000.

ALAVA, DON MIGUEL RICARDON', a Spanish general and statesman, born at Vittoria in 1771. In politics he followed a very devious course. After the insurrection of La Granja he refused to sign the constitution of 1812, and was obliged to retire to France, where he died in 1843.

ALAY, a Turkish ceremony observed on the assembling of the forces at the outbreak of war. Its essential feature is the public display of the sacred standard of Mahomet, which may be seen only by Moslems and touched only by the emirs.

ALB, or ALBE, a vestment of white linen, hanging down to the feet, worn by priests at all the more solemn services of the church. It corresponds to the surplice of the English clergy, the difference being that the alb is closer in the sleeves, and bound at the waist by a girdle.

ALBA, the ancient *Alba Pompeia*, a town of Italy. It has a large trade in cattle, and the surrounding district is very fertile, producing silk, wine, oil, grain, and fruits, and also marble and rock-salt. Population of the commune, 13,200.

ALBA LONGA, the most ancient town in Latium. It derived its name probably from its elevated or *Alpine* situation. Fourteen kings, whose names are all preserved, are said to have reigned over it in succession. The city was destroyed by the Romans under Tullus Hostilius, and its inhabitants removed to Rome.

ALBACETE, one of the new provinces of Spain, was formed in 1833 out of districts taken from Murcia and New Castile. The area is 5,971 square miles. Agriculture is in a tolerably prosperous state, more advanced than in the center of Castile. Cereals, pulse and fruits of all kinds are produced, as well as wine of fair quality, and excellent honey. Saffron also is produced in large quantities, and some attention is given to the keeping of silk-worms. Many of the inhabitants devote themselves

to the rearing of cattle, sheep and goats. The bulls of Albacete are in request for bull-fights. Population in 1897, 233,005.

ALBACETE, a town of Spain, capital of the above province, is situated about 140 miles S.E. of Madrid, and is a station on the railway between Madrid and Valencia. It has considerable trade in saffron and in the agricultural products of the district. A great market, chiefly for the sale of cattle, is held annually in September, and extends over several days. Albacete is famous for its daggers, which are held in high repute and much worn by the Spaniards. They are formidable weapons, but with richly-ornamented handles, and frequently bear proverbial inscriptions suitable to their murderous appearance. Population, about 21,000.

ALBAN, ST., usually styled the protomartyr of Britain, was born at Verulamium, and flourished towards the end of the third century. Alban suffered martyrdom during the great persecution in the reign of Diocletian.

ALBANI, FRANCESCO (1578-1660), a celebrated Italian painter, was born at Bologna. His father was a silk merchant. His first master was Denis Calvart, with whom Guido Reni was at the same time a pupil. Albani, after having greatly improved himself in the school of the Caracci, went to Rome, where he opened an academy and resided for many years. His best frescoes are those on mythological subjects, of which there is a large number in the Verospi Palace, now Torlonia. His second wife and children were very beautiful, and served him for models. The learning displayed in the composition of his pictures, and their minute elaboration and exquisite finish, gave them great celebrity, and entitle them to a distinctive place among the products of the Bolognese school.

A great number of his works are at Bologna. Among the most celebrated of his pictures are the "Four Seasons;" "Diana and Venus," in the Florentine gallery; the "Toilet of Venus," in the Louvre; "Venus landing at Cythera," in the Ghigi palace at Rome, &c. Among the best of his sacred subjects are a "St. Sebastian" and an "Assumption of the Virgin," both in the church of St. Sebastian at Rome. He was among the first of the Italian painters to devote himself to the painting of cabinet pictures.

ALBANIA, a country of considerable extent, which though frequently ruled by turbulent and nearly independent chiefs, ranks as one of the provinces of the Turkish empire. The superficial area of Albania is estimated at about 18,944 square miles, and it has a coast-line of about 280 miles from north to south, without reckoning indentations, &c. It nowhere extends more than 100 miles from the sea, and in the southern part not more than 30 miles.

The inhabitants of Albania are estimated at 1,200,000, of whom a considerable proportion are Turks and Greeks; but the basis of the population consists of the original race, called *Arnauts*. About half of the entire population are Mahometans; of the other moiety, about 520,000 belong to the Greek Church, and the remainder to the Latin Church. The native Albanian is of middle stature; his face is oval, with high cheek-bones; his neck long; his chest full and broad. His air is erect and majestic to a degree which never fails to strike the traveller. He holds in utter contempt that dissimulation which is characteristic of the Greek, and, unlike the Turk, he is gay, lively, and active. Averse, however, to regular industry, his whole delight is in arms and plunder.

This fierce and haughty race display a greater degree of contempt for the female sex than is usual even among the most barbarous nations. The females are literally regarded as inferior animals, and treated accordingly

but in the country districts they are not confined or veiled, as is customary in Mahometan countries.

The national costume of the Albanians is handsome in appearance, and bears some resemblance to the Highland dress. It consists of a cotton shirt, a white woollen or kilt, which reaches to the knees, and a jacket.

ALBANIA, in *Ancient Geography*, a country of Asia. The ancient historians describe the Albanians as tall, strong-bodied, and generally speaking, of a very graceful appearance. They became known to the Romans during Pompey's expedition in pursuit of Mithridates (65 B. C.), against which they opposed a force of 60,000 infantry and 22,000 cavalry.

ALBANO, a town and lake in the Campagna di Roma, Italy, about 14 miles S. E. of Rome. It is well built, and the Roman aqueduct and other monuments of antiquity are in tolerable preservation. It contains a cathedral, and there are many handsome villas of the Roman nobles in the vicinity. Population, 6,400.

ALBANY, the county seat of Lynn county, Oregon, is situated on the east bank of the Willamette river, twenty-eight miles south of Salem and eighty-one miles southwest of Portland, at the junction of the Oregon and California and Oregon Pacific railroads. The country in the vicinity is well cultivated and highly productive, and Albany is made the shipping point for the produce, as also the supply depot for the residents of a large area. The city contains three banks, one daily and two weekly papers, also a periodical issued monthly, seven churches, district schools, and the Albany Collegiate Institute, hotels, public halls, private residences, stores, etc., besides manufactures of woolens, iron, lumber, flour, furniture, sash, doors and blinds, etc. The population in 1900 was 3,149.

ALBANY, a city of the United States, capital of the State of New York and of the county of Albany, picturesquely situated in a beautiful and fertile country on the western bank of the Hudson, 145 miles from New York. Albany is an important center of trade, being situated at the point where the united Erie and Champlain canals join the Hudson, and possessing good railway communication with most cities of the United States. The city's annual receipts and disbursements, in 1901, were about \$2,820,000; general and water debt, \$4,650,000; assessed valuation of real estate, \$60,000,000; rate of taxation, \$21.00 per \$1,000. The year's expenditure on education amounted to \$294,064, of which \$218,045 was for teachers' salaries. Albany was founded by the Dutch in 1623, and is thus one of the oldest European settlements in the United States, dating sixteen years after that of Jamestown in Virginia. It was captured by the British in 1664, who changed its name from Beaverwyck or Williamstadt in honor of the Duke of York and Albany. It received its charter in 1686, and became the capital of the State of New York in 1797. Albany has a fine city hall, a high school, one large and several small public parks, a theater, an opera house and a music hall, a celebrated county prison, Roman Catholic and Episcopal cathedrals, and many other handsome churches; several academies and private schools, a noted State normal school, a law school, a medical college, an astronomical observatory, various hospitals and infirmaries, a large United States government building, and a very costly and splendid State capitol, considered the finest building of its class in the whole republic. Population in 1900, 94,151.

ALBANY, the county seat of Dougherty county, Ga., is situated on Flint river, at the head of navigation, 107 miles from Macon. It is also on the southwestern division of the Central Railroad of Georgia, and is an important shipping point on the Savannah, Florida and Western system. The city contains four banks, a

daily and weekly paper, eight churches; has a graded school system, in addition to private schools and academies; four hotels, an opera-house, public halls, many stores, and handsome public buildings and private residences. The manufactures carried on embrace carriages, lumber, sash, doors and blinds, foundry and machine work, flour, oil, some agricultural implements, etc. The population in 1900 was 4,606.

ALBANY, LOUISA MARIA CAROLINE, COUNTESS OF, daughter of Prince Gustavus Adolphus of Stolberg-Gedern, was born at Mons on the 27th September, 1753, and assumed the title of Countess of Albany in 1772, when she married the Pretender, Charles Edward, grandson of James II., the deposed king of England. In 1780 she obtained a legal separation, and entrusted herself to the care of her husband's brother, the Cardinal of York, who placed her in a convent, and afterward removed her to his own house at Rome. Here she was frequently visited by the poet Alfieri, who made her the object of what seems to have been the only pure attachment of his life, and who, according to his own avowal, was indebted to her influence for all that was best in his works. (See ALFIERI.) In 1788 she was freed from her bonds by the death of the Pretender, and in the same year she is said to have been secretly married to Alfieri. For the remainder of her life she resided at Florence, where she continued to be known as Countess of Albany, and distinguished herself as a patroness of literary men and artists. She died in 1824.

ALBATEGNI, an Arabian astronomer. His astronomical observations extended from 877 A. D. to his death in 929, and were principally conducted at Rakkah or Aracta, on the Euphrates, and at Antioch, in Syria.

ALBATROSS, a genus of aquatic birds closely allied to the Petrels and Gulls. They have the beak large, strong, and sharp-edged, the upper mandible terminating in a large hook; the wings are narrow and very long; the feet have no hind toe, and the three anterior toes are completely webbed. Of the three species that the genus includes the best known is the common or Wandering Albatross, which occurs in all parts of the Southern Ocean, and in the seas that wash the coast of Asia to the south of Behring Strait. It is the largest and strongest of all sea-birds. Its strength of wing is very great. It often accompanies a ship for days—not merely following it, but wheeling in wide circles round it—without ever being observed to alight on the water, and continues its flight, apparently untired, in tempestuous as well as in moderate weather. It has even been said to sleep on the wing.

ALBAY, a town of Luzon, the chief of the Philippine Islands. It is the capital of the fertile province of the same name, and is situated about 260 miles S. E. of Manila. Population, 12,000.

ALBERONI, GIULIO, cardinal and statesman, was born near Piacenza, probably at the village of Fiorenzuola, on the 31st May, 1664; died in 1752.

ALBERT (ALBRECHT) I., Duke of Austria, and afterward King of Germany, born in 1248, was the son of Rudolph of Hapsburg, the founder of the imperial Austrian dynasty. Rudolph having acquired the duchy of Austria by conquest, vested it in his son, with consent of the electors, in 1282, and thus founded the dynasty which still reigns. He also endeavored to secure for Albert the succession to the throne of Germany, but was unsuccessful. On the death of his father in 1291, Albert seized the insignia of sovereignty, and, with characteristic presumption, declared himself king of Germany, without regard to the decision of the electors. Their choice fell (1292) upon Adolphus of Nassau, and Albert who was called to suppress a revolt among his subjects in Switzerland, found it necessary to

acknowledge the superior claims of his rival. The government of Adolphus having become displeasing to the electors, they formally deposed him in 1298, and named Albert his successor. As, however, the former refused to recognise their verdict, the matter had to be referred to the arbitrament of the sword. The forces of the rival kings met at Gölheim, near Worms, where the army of Adolphus was defeated, and he himself slain by Albert's own hand. Upon this, Albert, wishing probably to show his moderation, resigned his claim to the throne; but he was re-elected, and crowned at Aix-la-Chapelle on the 24th August 1298. Pope Boniface VIII., however, denied the right of the electors, and refused to confirm their choice, alleging that the empire belonged to him alone to hold or bestow at his pleasure. In league with Philip the Fair of France, Albert at first openly resisted the pope; but soon finding it advisable, to change his policy, he deserted his ally, admitted the papal jurisdiction, and was rewarded with the kingdom of the deposed Philip. The attempt to bind his yoke more firmly upon the Swiss cantons caused the revolt of Unterwalden, Schwyz, and Uri, in January 1308, and thus laid the foundation of the Swiss Confederation. It was while endeavoring to check this revolt that Albert met his death at the hand of his nephew, John of Habsburg, whose claim to his father's dominion of Swabia had been refused in the most insulting terms by the king. He died in the arms of a beggar woman, who happened to be passing.

ALBERT EDWARD, King Edward VII., eldest son of Queen Victoria, became King of Great Britain and Ireland, and Emperor of India, by the death of his mother, January 22, 1901. He was born at Buckingham Palace on the 9th of November, 1841, studied under private tutors and finished education at Edinburgh, Oxford and Cambridge Universities. He visited the United States and Canada in 1860, traveled through the East with Dean Stanley in 1862 and on March 10, 1863, was married to the Princess Alexandra, eldest daughter of Christian IX. of Denmark, who was born on December 1, 1844. Two sons and three daughters were born of this union,—the former being: Prince Albert Victor Christian Edward, Duke of Clarence (born January 8, 1864, at Frogmore Lodge, Windsor, died at Sandringham House, January 14, 1892), and Prince George, Duke of York (born at Marlborough House, June 3, 1865, and married to Princess May of Teck on July 6, 1893). He is fond of outdoor sports, takes a lively interest in charitable institutions, bettering the conditions of the poor, etc., and was largely responsible for the establishment of the Royal College of Music and the Imperial Institute. His country seat is Sandringham, which is his favorite place of abode. His titles are Prince of the United Kingdom of Great Britain and Ireland; Prince of Saxe-Coburg and Gotha; Duke of Saxony; Great Steward of Scotland; Duke of Cornwall and Rothsay; Earl of Chester, Carrick and Dublin; Baron Renfrew, etc. His patronage consists of 29 livings which are vested chiefly in his title of Duke of Cornwall.

ALBERT, Cardinal Archbishop of Magdeburg and Elector of Mentz, born 1489, was the youngest son of John, Elector of Brandenburg. In 1513 he was consecrated archbishop of Magdeburg, and about the same time he was chosen administrator of the diocese of Halberstadt. For the *pallium* in connection with the appointment of archbishop the pope demanded the exorbitant sum of 30,000 ducats, but enabled the archbishop to recoup himself by granting him the privilege of selling indulgences throughout his diocese. It was his employment of the Dominican Tetzl in this service which, by calling forth Luther's famous ninety-five theses, had so important an influence on the course of the Reformation. In 1518 he was created a cardinal as

a reward for his services to the Romish church. He died at Mentz on the 24th September, 1545.

ALBERT (PRINCE), FRANCIS CHARLES AGUSTUS ALBERT EMANUEL, Prince Consort of England, born at Rosenau on 26th August, 1819, was the second son of the hereditary Duke of Saxe-Coburg-Gotha, by his first wife, the Princess Louise of Saxe-Gotha-Altenburg. The marriage of his parents proving an unhappy one, they separated in 1824, and the young prince never again saw his mother, who died in 1831. At the proper age he and his brother proceeded to the university of Bonn. Prince Albert devoted himself especially to the natural sciences, political economy, and philosophy, having for teachers men of such world-wide fame as Fichte, Schlegel, and Perthes.

In 1836 the prince visited England in company with his father, and met his future consort for the first time. From the time of the queen's accession there seems to have been a family understanding on the subject, though, owing to the youth of the prince and his cousin, no formal engagement was entered into till two years later. In the winter of 1838-39 the prince traveled in Italy, accompanied by Mr. Seymour, a young English gentleman. A year later the hopes of many were realized when, on the 23d November, 1839, the queen announced to the Privy Council her intended marriage with her cousin. On the 10th February, 1840, the marriage was celebrated at the chapel-royal, St. James, amid universal rejoicings. A few days before the event two bills had been passed in parliament, one naturalizing the prince as a British subject, and the other providing an annuity of £30,000 a year for the maintenance of his establishment. In 1857 he received by letters patent the formal title of "Prince-Consort," which was conferred upon him in order to settle certain difficulties as to precedence that had been raised at foreign courts.

It was in the prime of manhood and the full career of his usefulness that the prince-consort was removed by death. He had been greatly occupied during the autumn of 1861 with the arrangements for the projected international exhibition, and it was just after returning from one of the meetings in connection with it that he was seized with his last illness. He died of typhoid fever on the 14th of December, 1861. Few have ever been more sincerely or more universally mourned. The grief of the queen was deep and lasting, and the whole nation sympathized in the truest sense with her in her sorrow.

ALBERT LEA, the capital of Freeborn county, Minn., is a flourishing city of nearly 5,000 inhabitants, situated on a small lake of the same name, 130 miles west of La Crosse. It contains seven churches, a high school, and several graded schools, two banks, foundries, brickyards, breweries, flouring mills and planing mills. It is an important shipping point for grain, and has five elevators and good railroad connections. Two weekly newspapers are published here. Albert Lea enjoys the advantage of an especially fine location, and is a well built and handsome town. In 1880 it had less than 2,000 inhabitants, and its growth has been steady and uniform.

ALBERT NYANZA, a large lake in East Central Africa. Its surface is 2,720 feet above the level of the sea. The White Nile, flowing in a northwesterly direction from Lake Victoria Nyanza, enters Lake Albert Nyanza, and issues from it near its northern extremity.

ALBERTI, LEON BATTISTA, distinguished as a painter, poet, philosopher, musician, and especially as an architect, was descended from the noble family of the Alberti, of Florence. He was born at Venice about the year 1404. In music he was reputed one of the first organists of the age. He is generally regarded as one of the restorers of the ancient style of architecture, and has

been called by some writers the Florentine Vitruvius. At Rimini he designed the celebrated church of San Francesco, which is generally esteemed his finest work. Alberti wrote works on sculpture, and painting, which are highly esteemed; but his most celebrated treatise is that on architecture, which has been translated into Italian, French, Spanish, and English. He died at Rome in 1472, or, according to others, in 1484.

ALBERTRANDY, JAN CHRZCICIEL, or JOHN CHRISTIAN, historian, was born in Warsaw in 1731. Educated in the public school of the Jesuits, he joined their order in his fifteenth year, and gave such proof of his ability that, at the early age of nineteen, he was appointed professor at the college of Pultusk. King Stanislaus Augustus appointed him, at the request of Lubieniski, keeper of his medals, and afterwards his reader and librarian. The representations he made to the king as to the extent and value of the materials for Polish history that were scattered throughout the libraries of Rome, induced Stanislaus to send him on a visit to Italy, in order that he might collect these materials. He devoted three years to the task. The *Excerpta*, all written with his own hand, filled 110 volumes of manuscript. To complete the collection, he subsequently visited Sweden, where the difficulty of the work was greatly increased by his being forbidden to copy any portions of the books or manuscripts he consulted. An excellent memory, however, enabled him in great measure to overcome the difficulty; and from the libraries of Stockholm and Upsala he made extracts which increased the entire collection to 200 volumes. In recognition of his merit the king bestowed on him the bishopric of Zenopolis. He was the first president of the Royal Society of the Friends of Science in Warsaw, and took a large share in its proceedings up to the time of his death, which occurred on the 10th August 1808.

ALBERTUS MAGNUS, a celebrated scholastic philosopher, was born of the noble family Von Bollstädt at Lauingen in Suabia. The date of his birth is most probably 1193. In 1223 he became a member of the Dominican order, and studied theology under its rules at Bologna and elsewhere. Selected to fill the position of lecturer at Cologne, where the order had a house, he taught for several years there, at Regensburg, Freiburg, Strasburg, and Hildesheim. In 1259 the pope made him bishop of Regensburg, which office he resigned after three years. The remainder of his life he spent partly in preaching throughout Bavaria and the adjoining districts; almost the last of his labors was the defence of the orthodoxy of his former pupil, Thomas Aquinas. He died in 1280, aged 87. Albert's works have been published in twenty-one folios. He was the most widely read and most learned man of his time.

ALBI, a city of France, capital of the department of the Tarn, is situated on the river Tarn, 41 miles N.E. of Toulouse. It is a place of great antiquity, and was a stronghold of the early French Protestants, giving its name to the Albigenes. Albi has woollen and linen manufactures; coal, iron, and copper are wrought in the vicinity; and the surrounding district is very fertile, producing much grain and fruit. Population about 20,000.

ALBIGENSES, a sect opposed to the Church of Rome. The Albigenes were kindred in origin and more or less similar in doctrine to the sects known in Italy as Paterins, in Germany as Catharists, and in France as Bulgarians, but they are not to be entirely identified with any of these. Still less ought they to be confounded, as has frequently been the case, with the Waldenses, who first appear at a later period in history, and are materially different in their doctrinal views. The descent of the Albigenes may be traced with tol-

erable distinctness from the Paulicians, a sect that sprang into existence in the Eastern Church during the 6th century. (See PAULICIANS.)

ALBINA, a new and growing city of Multnomah county, Oregon (population at the census of 1900, restricted). It is situated on the Willamette river, twelve miles from its mouth and one mile from East Portland, and is an important grain-shipping point. Albina contains a ship-yard, saw-mills, machine shops and foundries.

ALBINO. The name *Albinism*, or *Leucopathia*, is applied to a remarkable peculiarity of the physical constitution of certain individuals, which consists in the skin and hair being perfectly white. Albinism is most common and most marked in the negro and Indian races, but it occurs in all parts of the world and among all the varieties of the human race. The appearance arises from the absence of the minute particles of coloring matter which ordinarily occur in the lowest and last-deposited layers of the epidermis or outer skin, and to the presence of which the skin owes its color. With very rare exceptions, it affects the entire body, and continues through life.

ALBINUS (originally WEISS), BERNARD SIEGFRIED, a celebrated anatomist, born in 1697 at Frankfort-on-the-Oder. He died in 1770.

ALBION is a post-village of Calhoun county, Mich., and is situated on the Kalamazoo river, twenty miles west of Jackson, and forty miles southwest of Lansing. It is at the intersection of two important railroads, and is a town (1900) of 4,519 inhabitants. Albion contains ten churches, one national and two other banks, several schools, and a public library. Two weekly newspapers are published, and there are manufactories of agricultural implements, sash, doors and binds, wind-mills, and machinery. Albion is also the seat of a Methodist institution of learning, Albion College, founded in 1860, which has over 200 students.

ALBION, the capital of Orleans county, N. Y., is eligibly situated on the Erie canal, thirty miles west of Rochester, and fifty-two miles northeast of Buffalo. It has good railroad service, contains two national banks, two newspaper offices, six churches, and a full complement of schools. It is also the seat of the Albion Academy, of the Phipps Union Seminary, and of a Roman Catholic academy. The principal industry is the milling of flour, and there are also manufactures of iron and other articles. The population (1900) is returned at 5,749; that of Albion village in the same year, 4,477.

ALBORNOZ, GIL ALVAREZ CARILLO DE, a cardinal of Spain, was born at Cuenca early in the 14th century, and died at Viterbo in 1367.

ALBRECHTSBERGER, JOHANN GEORG, a celebrated musician, born at Kloster-Neuburg, near Vienna, on the 3d of February, 1736. He became one of the most learned and skillful contrapuntists of his age. He was appointed in 1772 organist of the court of Vienna, and in 1792 kapellmeister of St. Stephen's cathedral. His fame as a theorist attracted to him in the Austrian capital a large number of pupils, some of whom afterward became eminent musicians. Among these were Beethoven, Hummel, Moscheles, Seyfried, and Weigl. Albrechtsberger died, in the full fruition of his fame and honors, in 1809.

ALBUERA, a small village of Spain, in the province of Badajoz, thirteen miles southeast of the town of that name. It was the scene of a great battle in 1811.

ALBUFERA DE VALENCIA, a lagoon, 7 miles south of Valencia in Spain, about 12 miles in length and 4 in breadth, 12 feet being its greatest depth. It

communicates with the sea by a narrow outlet, which can be opened or closed at pleasure. The lake is crown property, and is of great value from the fish and wild fowl with which it abounds.

ALBUM (*albus*, white), originally denoted a tablet on which decrees, edicts, and other public notices were inscribed in ancient Rome. In modern times album denotes a book in which verses, autographs, sketches, photographs, &c., are collected.

ALBUMAZAR (ABU-MAASCHAR), a celebrated Arabian astronomer, born at Balkh, in Turkestan, in 805 A.D., died at Wasid in 885.

ALBUMEN, an organic substance of a very complicated structure. It is typical of a group of bodies that have the same chemical composition but very different properties. The principal varieties are named albumen, fibrin, and casein. They are sometimes called the histogenetic bodies, because they are essential to the building up of the animal organism. From its property of coagulating when heated, albumen is employed in the arts to remove coloring matter from liquids.

ALBUQUERQUE, one of the most important cities of New Mexico, and the capital of Bernalillo county, is situated on the Rio Grande, about sixty miles southwest of Santa Fé. It stands at an elevation of 5,000 feet above the sea, and is a handsome and prosperous town, with a population (1900) exceeding 6,230. The city is lighted by gas and electric lights, and possesses a street railroad, a number of hotels, churches, and schools, and a house of Jesuits. Albuquerque has some manufactures, and is the principal market of the Territory for wool and hides. It was formerly the seat of a Spanish mission, and was visited in early days by the Spanish explorers and the Jesuit fathers. Many of the older buildings are of historic interest.

ALBUQUERQUE, a town of Spain, in the province of Badajoz, 9 miles from the frontiers of Portugal. It has woollen and linen manufactures, and exports cattle and fruits. Population, 7,000.

ALBUQUERQUE, ALPHONSO D', surnamed "The Great," and "The Portuguese Mars," was born in 1453 at Alexandria, near Lisbon. Through his father, Gonzalvo, who held an important position at court, he was connected by illegitimate descent with the royal family of Portugal, and through his mother, Dona Lenora de Menezes, he could claim kindred with Zarco and other illustrious navigators. He was appointed *estribeiro-mor* (chief querry) to João II. In 1503 he set out on his first expedition to the East, which was to be the scene of his future triumphs. In company with his kinsman Francisco he sailed round the Cape of Good Hope to India, and succeeded in establishing the king of Cochin securely on his throne, obtaining in return for this service permission to build a Portuguese fort at Cochin, and thus laying the foundation of his country's empire in the East. Albuquerque's great career had a painful and ignominious close. He had several enemies at the Portuguese court who lost no opportunity of stirring up the jealousy of the king against him. On his return from Ormuz, at the entrance of the harbor of Goa, he met a vessel from Europe bearing despatches announcing that he was superseded. He died at sea December 16, 1515.

ALBURNUM, or SAPWOOD, is the youngest and most external portion of the wood of ordinary dicotyledonous trees. It is still imperfectly hardened and lies between the BARK (*q.v.*) and the heartwood or duramen.

ALCÆUS, one of the great lyric poets of Greece, was a native of Mitylene in Lesbos, and flourished about the year 600 B.C. Horace looks upon Alcæus as his

great model, and has given a fine picture of the poetical powers of the Æolian bard. The care which Alcæus bestowed upon the construction of his verses was probably the reason why one kind of metre, the Alcaic, was named after him.

ALCAICS, in *Ancient Poetry*, a name given to several kinds of verse, from Alcæus, their reputed inventor.

ALCAIDE, or ALCAYDE, a word of Moorish origin, meaning to head, was applied by the Spanish, the Portuguese, and the Moors, to the military officer appointed to take charge of a fortress or prison. See ALCALDE.

ALCALA DE GUADAIIRA, a town of Spain, in the province of Seville, Andalusia, situated on the Guadaira, 7 miles E. of Seville. Nearly the whole of the bread required by the town of Seville is made here. Population, 8,298.

ALCALA DE HENARES, an ancient Spanish city on the river Henares, 17 miles E.N.E. of Madrid. In later times it was renowned for its richly-endowed university, founded by Cardinal Ximenes in 1510, which, at the height of its prosperity, numbered more than 10,000 students, and was second only to that of Salamanca. Here the famous edition of the Holy Bible known as *Complutensian Polyglot* was prepared. Alcala is further celebrated as the birthplace of the German emperor Ferdinand I., the poet Figueroa, the naturalist Bustamente de la Camera, the historian Solis, and last and greatest of all, Cervantes, who was born here in 1547. Population, 12,317.

ALCALA LA REAL, a town of the province of Jaen in Spain. In 1810 the Spaniards were defeated here by the French under Sebastiani. Some trade is carried on at the place in wine and wool. Population, 15,901.

ALCALDE, the judge, an official title given in Spain to various classes of functionaries entrusted with judicial duties. Criminal judges, members of courts of appeal, magistrates, and even parish officers are all known by the name *alcalde*.

ALCAMENES, a famous Athenian sculptor, a pupil of Phidias, who is celebrated for his skill in art by Cicero, Pliny, Pausanias, Lucan, &c. He flourished from about 448 to 400 B.C., and appears as one of the great triumvirate of Greek sculptors, Phidias, Alcamenes, and Polyclethus.

ALCAMO, a city of Sicily, in the Italian province of Trapani, is situated 22 miles E. of Trapani. It lies in a district of peculiar fertility, which produces some of the best wines in the island.

ALCANTARA, a town of Spain, in the province of Caceres, on a rocky height on the left bank of the Tagus. Alcantara, *the bridge*, derived its name from the magnificent Roman bridge which spanned the Tagus at this point, and which was erected, according to the inscription, A.D. 104, in honor of the emperor Trajan, who was a native of Spain. The population of the town is 4200.

ALCANTARA, a seaport of Brazil, in the province of Maranhao, on the bay of San Marcos. Excellent cotton is grown in the vicinity, forming the chief article of commerce. Rice and salt, obtained from the neighboring lagoons, are also exported. Population, 10,000.

ALCANTARA, KNIGHTS OF, an order of knights of Spain, instituted about 1156 A.D. by the brothers Don Suarez and Don Gomez de Barrientos for protection against the Moors. In 1177 they were confirmed as a religious order of knighthood under Benedictine rule by Pope Alexander III. Until about 1213 they were known as the Knights of San Julian del Pereyro; but when the defence of Alcantara, newly wrested from the Moors by Alphonso IX. of Castile, was entrusted to

them, they took their name from that city. When Joseph Bonaparte became king of Spain in 1808, he deprived the knights of their revenues, which were only partially recovered on the restoration of Ferdinand VII. in 1814. The order ceased to exist as a spiritual body in 1835, though it is still recognised in its civil capacity.

ALCARAZ, a small town in Spain, in the province of Albacete, 34 miles W.S.W. of the town of that name. Weaving, iron-founding, and agriculture are the chief branches of industry. Copper and zinc are found in the vicinity. Population, 4,392.

ALCAVALA, a duty formerly charged in Spain and its colonies on all transfers of property, whether public or private. It was originally imposed by Alphonso XI. to secure freedom from the Moors in 1341, as an *ad valorem* tax of 10, increased afterwards to 14 per cent., on the selling price of all commodities, whether raw or manufactured, which was chargeable as often as they were sold or exchanged. It subjected every farmer, every manufacturer, every merchant and shopkeeper, to the continual visits and examination of the tax-gatherers, whose number was necessarily very great. This monstrous impost was permitted to ruin the industry and commerce of the greater part of the kingdom down to the invasion of Napoleon. Catalonia and Aragon purchased from Philip V. an exemption from the alcala, and, though still burdened with other heavy taxes, were in a comparatively flourishing state, in consequence of their exemption from this oppressive duty. (See McCulloch *On Taxation*.)

ALCAZAR DE SAN JUAN, a Spanish town, in the province of Ciudad Real, 45 miles N.E. of Ciudad Real, and on the railway between Alicante and Madrid. Population, 8,721.

ALCAZAR KEBIR, a city of Morocco in Africa, eighty miles northwest of Fez. It was formerly of great note as the magazine and place of rendezvous for the Moorish invasions of Spain. Population, 9,000.

ALCESTER, pronounced *Auster*, a market town in the county of Warwick, England, at the junction of the Arrow and Alne, 14 miles W.S.W. of Warwick. Its position on the Roman way known as the Ickenild Street, and the discovery of numerous remains of ancient art, as well as urns and coins, make it sufficiently evident that this was a Roman encampment. Population of parish, 2363.

ALCESTIS, or ALCESTE, the daughter of Pelias and Anaxibia, and the wife of Admetus, king of Phææ in Thessaly. She consented to die in place of her husband, and was afterwards restored to life by Hercules.

ALCHEMY, CHEMY, or HERMETICS. Considering the present state of the science and the advance of public opinion, the old definition of alchemy as the pretended art of making gold is no longer correct or adequate.

Modern science dates from three discoveries—that of Copernicus, the effect of which (to borrow St. Simon's words) was to expel the astrologers from the society of astronomers; that of Torricelli and Pascal, of the weight of the atmosphere, a discovery which was the foundation of physics; lastly, that of Lavoisier, who, by discovering oxygen, destroyed the theory of Stahl, the last alchemist who can be excused for not being a chemist.

Before these three grand stages in the progress of science, the reign of astrology, magic, and alchemy was universal and almost uncontested. Even a genius like Kepler, who by his three great laws laid the foundations for the Copernican system, was guided in his investigations by astrological and cabalistic considerations. Hence it follows that a philosophical history of modern science is certain to fall into the opposite superstition of idolising abstract reason, if it does not do full justice to this long and energetic intellectual struggle which began in India,

Greece, and Egypt, and, continuing through the dark ages down to the very dawn of modern enlightenment, preceded and paved the way for the three above-mentioned discoveries, which inaugurated a new era.

It was the alchemists who first stated, however confusedly, the problems which science is still engaged in solving; and to them, in conclusion, we owe the enormous service of removing the endless obstructions which a purely rationalistic method, born before its time and soon degenerating into verbal quibbles and scholastic jargon, had placed in the path of human progress.

Alchemy was, we may say, the sickly but imaginative infancy through which modern chemistry had to pass before it attained its majority, or, in other words, became a positive science. The search for gold was only one crisis in this infancy. This crisis is over, and alchemy is now a thing of the past. Those ancient cosmogonies, those poetical systems which the genius of each nation and race has struck out to solve the problem of the universe and of the destiny of mankind, were the germs of science no less than literature, of philosophy as well as of religion. And as in the infancy of science its various branches were confused and confounded, so in a like stage of society we often find the same person uniting the parts of philosopher, *savant*, and priest. Besides this, it is evident that in the absence of all scientific apparatus or instruments, the ancients, if they had limited themselves to the exercise of their reason, must have remained observers and nothing more. It is true they did observe, and that widely and well; but observation alone, even when aided by the strongest and subtlest reason, can lead to nothing but contradictory theories, irreconcilable, because they cannot be verified. And it is not in human nature to remain a simple spectator. Curiosity was first excited by fancy (and the fancy of primitive man, we must remember, was far more active and vigorous than ours), and when it found itself baffled by a natural reaction, it had recourse to divination.

In a word, the ambition of these earliest philosophers was more intense, because its sphere was narrower. In the first stages of civilization the magician was the man of science. The mysteries of this magic art being inseparable from those of religion and philosophy, were preserved, as it were, hermetically sealed in the adyta of the temple. Its philosophy was the cabala. We must consequently look on the various cabalas or oral traditions, transmitted from age to age as the oracles of various faiths and creeds, as constituting the elements of that theory which the Jewish cabala promulgated some centuries later in a condensed and mutilated form. Astrology and magic were the efforts made in various ways to verify and apply this theory; magic, indeed, or rather magical power, was at starting purely cosmogenic, *i.e.*, regarded as an attribute of God or nature, before it was counterfeited by the magicians of various countries. But, as St. Simon has well observed, chemical phenomena are much more complicated than astronomical—the latter requiring only observation, the former experiment—and hence astrology preceded alchemy. But there was then no hard and fast line between the several branches of science, and hence the most opposite were united, not, as now, by a common philosophical or philanthropical object, but by reason of their common theological origin. Thus alchemy was the daughter of astrology, and it was not till the end of the 16th century A.D. that she passed from a state of tutelage. Just in the same way medicine as a magical or sacred art was prior to alchemy; for, as was natural, before thinking of forming new substances, men employed already existing herbs, stones, drugs, perfumes, and vapors. The medical art was indissolubly bound up with astrology, but, judging from the natural inventive-

ness of the ancients, we should have expected beforehand that chemical preparations would have played a more important part among the instruments of priestly thaumaturgy.

After this general introduction we may now proceed to consider the subject in detail under the following heads:—First, we will cast a rapid glance at certain cosmogonies and philosophical systems, in order to bring prominently before the reader those points which throw light on chemical theories. Secondly, we will consider alchemy at the moment when it ceased to be purely religious and began an independent existence; that is to say, during the 3d and 4th centuries A.D., and in that city which was the battlefield on which the various philosophical and religious creeds of the East met.

COSMOGONIES AND PHILOSOPHIES.

In India, as is well known, the contempt in which the caste of artisans was held was still farther increased by the tendency of religion to consider birth and life, and the actions and desires which are part and parcel of man's life, as an unmixed evil. Consequently, outside the workshop, practical chemistry can have made but little progress. Nevertheless, among the priests of India, as in later times in Europe, we find the ordeal of fire and of serpents commonly practised. It follows that the Brahmins must have possessed some chemical secrets to enable them to kill or save those they thought guilty or innocent. These secrets, too, must from time to time have been divulged by indiscretion or perfidy, and spread beyond the temple; for we read of accused persons escaping unharmed from the ordeal, even when their accuser was a Brahmin. But the Mussulman traveller of the 9th century, who has preserved this curious detail, allows that the trial was in his day becoming more elaborate and complicated, and that it was next to impossible for an accused person to escape. However this may be, it is certain that the meditative genius which distinguishes the race had, even before they conquered the yellow and black races, led these first speculators to certain conceptions which have an important bearing on the present subject. Some had conceived ether as composed of distinct atoms, others imagined an ether decomposing itself into atoms by the free play of its own forces. These two theories, the one dualistic, the other unitarian, strangely foreshadow the discoveries of modern dynamics. We find the speculators of another race indulging the singular fancy that they could observe in atoms what we may call osculations of the play of forces. The Persians, who considered the first tree and the first bull as the two ancestors of man, discovered in physics generally two antagonistic principles, one male and one female, primordial fire and primordial water, corresponding to the good and bad principles of their religion. Over all creatures and all things there were presiding genii, *Tæds* or *Feroners*. They had already formulated the parallelism between *Sephiroth*, the empyrean, the *primum mobile*, the firmament, Saturn, Jupiter, Mars, Sun, Mercury, Moon, and the parts of the body, brain, lungs, heart, &c. In this correspondence between the heavenly bodies and the human frame which the ancient Persians laid down, and the Hindu belief in the peregrination of sinful souls through the animal, vegetable, and even the mineral world, till, by these pilgrimages, they at last won absorption into the Deity, or *Monetti*, we have in their original form, the two fundamental beliefs of alchemy.

The Greeks, unrivalled as they were in poetry, art, and ethics, made little way in occult philosophy. The Greek intellect, precise and anthropomorphic, with no leaning to transcendentalism, was a protest against the boldness of oriental metaphysics. Thus they contented

themselves with inventing a strange gamut of deities corresponding to different types of men. This gamut—Jupiter, Saturn, Apollo, Mercury, Mars, and Venus—was afterwards completed in the cabala by the addition of the moon, typifying the phlegmatic character of northern races, and forms a connecting link between astrology and alchemy, by establishing a double correspondence between planets of the same name and metals. The whole was systematised in the works of Paracelsus and Böhme, and called the theory of *signatures*. Whether the Greek philosophers taught that the principle of all things was water, like Thales, or air, like Anaximander, or air and water, as Xenophanes, or the four elements, earth, air, fire, and water, as the school of Hippocrates, the tendency of Greek speculation was to establish those profound distinctions which resulted later in the theory of the four elements, the four humors, &c., which the disciples of Aristotle held. Hippocrates, for example, thought that if man was composed of a single element, he would never be ill; but as he is composed of many elements, complex remedies are required. Thus Hippocrates may be called an anti-alchemist; and though the theory of the four elements reigned supreme throughout the middle ages, it easily lent itself to the search for the philosopher's stone and the universal panacea, because the oriental idea of the transmutation of elements, from the time when the various systems of the East were syncretised at Alexandria and received their final development in Arabia in the writings of Geber Rhasis and Ibn Sina (Avicenna), was a universal article of belief. But even in the palmiest days of Greek anthropomorphism there was a gradual infiltration of Asiatic ideas, partly through the mysteries of Eleusis, partly through the doctrines of certain philosophers, who were by nature susceptible of barbaric influences. For, besides Greece proper, there was a second Greece in Asia Minor and a third in Italy, not to mention the Pelagic tribes who adhered tenaciously to the primitive ideas of the race.

THE SACRED ART.

Paganism, at the time when it was engaged in its last struggle with Christianity, had long ceased to be exclusively Greek or Roman. It had assimilated Mithratic, Chaldean, and Egyptian mysteries, and even allied itself to a certain extent with the Helleno-Hebraism of the Cabala. It was not likely, then, to reject what purer times would have regarded as an utter profanation. The narrow ground on which the battle was fought, the intellectual affinities between such men as St. Basil and the emperor Julian rendered the struggle as desperate and sanguinary as any struggle can be when the combatants are only rival creeds. The sacred and divine art, the sacred science, was one of the mysteries which paganism derived from the dim religious light of the temple. But we may presume that the sacred art of the Alexandrians was no longer the same as that of the ancient Egyptians, that their Hermes was not the Hermes of Egypt, that the pseudo-Democritus is not the true Democritus, that Pythagoras, as retouched by Iamblicus, is not the original Pythagoras. No epoch was so full of forgeries as the 3d and 4th centuries A.D.; and these forgeries were in one sense fabricated in good faith. An age of eclecticism is as eager for original documents as a *parvenu* is for a coat of arms or a genealogical tree. These forgeries were no obstacle to human progress; but in an age when the learning of Egypt was the fashion, it was natural that Persian, Jewish, and Platonic doctrines should be tricked out in an Egyptian dress. One of the masters of the sacred art, Alexander of Aphrodisias, invented the term *chymis* (from to pour, to fuse or melt)

to describe the operations of the laboratory. Hence the word *chemics*, a word unknown in the 4th century, and only popular some centuries later. The reason is, that the true etymology of the word *chemic* is logical, and had therefore no charms for the psychological spirit of the age. Later on, when men began to reflect that the ancient name for Egypt was *Cham* or *Chemia*, because, according to Plutarch, its soil was black like the pupil of the eye, it flattered chemists to call chemistry "the art of the ancient Chemi." Hence from a false derivation the art received a fresh impulse.

The discovery of the principal manuscripts of the sacred art we owe to the labor of M. Ferdinand Hoefcr.

But neither M. F. Hoefcr's explanation of the appearances which the first master of the sacred art mistook for fact, nor the metaphysical theory of Nemesius, will enable us to understand how Zosimus the Theban, in the very infancy of the art, succeeded in discovering in sulphuric acid a solvent of metals; in assigning to mercury (which he called "holy water") its proper function, a function which succeeding generations of alchemists so monstrously exaggerated; and finally in disengaging from the red oxide of mercury oxygen gas, that Proteus which so often eluded the grasp of the alchemists, till at last it was held fast by the subtle analysis of Lavoisier. For we must remember that solid metals were considered as living bodies, and gases as souls which they allowed to escape. Of all the ingenious inventions of the Jewess Maria for regulating fusions and distillations, the only one that has survived is the *Balneum Marie*. The principle it depends on, viz., that the calcination of violent heat is less powerful as a solvent or component than the liquefaction produced by gentle heat, was afterwards reasserted by the Arabian Geber, and advocated by Francis Bacon. M. Hoefcr imagines that Maria the Jewess discovered hydrochloric acid, the formidable rival of sulphuric acid. Succeeding writers on the history of chemistry have remarked that the bandages of Egyptian mummies were not more numerous than the mysteries of the sacred art, and the injunctions not to divulge its secrets, "under pain of the peach tree," or, to translate into modern English the language of an ancient papyrus, under pain of being poisoned by prussic acid. We should be wrong in thinking that all these allegories had no meaning for the initiated, and that this mystical tendency of the sacred art arrested its growth at starting. Rather the truth is, that these myths, which at a later stage prevented the free development of alchemy, at first served to stimulate its nascent powers.

Modern critics have pronounced some traditional sayings of Hermes Trismegistus to be apocryphal, but they have not given sufficient weight to the remarkable circumstance that it is precisely because these sayings are a medley of the cabalistic, gnostic, and Greek ideas with which Alexandria was then seething, that the seven golden chapters, the Emerald Table, and the Pimander obtained their authority—an authority they would never have possessed had they been only a translation of some obscure Egyptian treatise. No Egyptian priest could have written a sentence like that we find so often quoted as an axiom by subsequent alchemists:—"Natura naturam superat; deinde verò natura naturæ congaudet; tandem natura naturam continet." Plato adds (not the disciple of Socrates, but a pseudo-Plato in the famous collection called *Turba Philosophorum*)—"contines autem omnia terra est." For, translated into modern language, this means that there may indeed be in this universe things which pass our intellectual ken; but that all that exists, all that is produced by the strife and the changes of the elements, all, in a word, that appears to us supernatural, is really natural. That this is his

meaning we may gather from the singularly bold comment which Plato himself adds, and which we may thus translate—"Everything, even heaven and hell, are of this earth." It is true that the alchemists failed to draw any very definite conclusions from this fundamental axiom. But if we consider it carefully, we shall see that this earliest doctrine of the sacred art, which was now rapidly passing into alchemy, by thus excluding the supernatural, was making a great advance in the direction of positive science. This early advance was, however, counterbalanced by an early error (which itself arose from a noble ambition), viz., that art is as powerful as nature. The Emerald Table begins with a sentence no less celebrated than that quoted above:—"This is true, and far distant from a lie; whatsoever is below is like that which is above, and that which is above is like that which is below. By this are acquired and perfected the miracles of the one thing." To understand the importance of this emphatic and categorical exordium, we must forget the sharp distinction we now draw between art, science, and literature; we must think of that foolishness of which St. Paul speaks, by which he sought to save those that believe, because of the insufficiency of human reason. The seekers for the philosopher's stone were in the same case. In the absence of clear facts and just notions, reason for them was not sufficient. Thus it was that they and the masters of the sacred art, and after them the Arabs, and in the later times the alchemists, one and all listened eagerly to the "foolishness" of the Trismegistus's doctrine, which in a modern form, would run thus:—"We go further than the *Zohar*—the sacred book of the cabala—which says that as soon as man appeared, the world above and the world beneath were consummated, seeing that man is the crown of creation and unites all forms. We go further than the *Zohar*, which says in another place that the lower world was created after the similitude of the upper world. We perfect the doctrine of a microcosm and a macrocosm, and declare that there is no such thing as high or low—as heaven or earth, for the earth is a planet, and the planets are earths; we affirm that the chemical processes of our alchemies are similar to those of the sidereal laboratories. All is in all. Everywhere analogy infers the same laws." From analogy to identity was an easy step for the theorists; and in the full light of the 19th century we find Hegel a devoted admirer of the mystic Böhme falling into this pitfall. If the *spectrum analysis* had been known, the Alexandrians, the Arabs, and the alchemists would have been able to verify and limit the sweeping generalisation by which they established a vast system of correspondences between the three worlds, the physical or material, the rational or intermediary, and the psychical or spiritual. Between the heavens and earth and man's nature they were ever seeking to discover affinities, and ignoring differences which would have been fatal to their system. Thus, according to them, even heaven—the abode of spirits—was partly physical; and even in the mineral world there was a spiritual element—viz., color, brightness, or, in their language, tincture. Neither Linnæus, Berzelius, nor Cuvier had yet classified living beings and things. The distinction between the animal, the vegetable, and the inorganic world was unknown, and indeed it was impossible that it should be known. The alchemists sought for physical conditions in the invisible and spiritual world, and for a spirit even in stocks and stones. This explains the magic which they found in nature, and which they tried to imitate by their art. But to establish this harmony between heaven, man, and nature, they required some fixed standard or scale, for in their eclectic system they were bound to find room for Pythagoras. Where

was this scale to be found? In the heavens; for there must be the sphere of true music. hence arose chemical, medical and physiognomical astrology. (See ASTROLOGY.)

Alchemy in Arabia.—How the sacred art passed into Moslem lands it is hard, from dearth of evidence, to say. Modern criticism now does more justice to the part which Arabia took in the accumulation of scientific facts, and in the scientific theories which we find in the books of Rhazès and Geber. It is certain that in their treatises with the European Greeks of Constantinople the Arabs always stipulated for the delivery of a fixed number of manuscripts. Their enthusiasm for Aristotle is equally notorious; but it would be unjust to imagine that, in adopting the Aristotelian method, together with the astrology and alchemy of Persia, and of the Jews of Mesopotamia and Arabia, they were wholly devoid of originality. On the other hand, we must not understand Arabia in the ethnological sense of the word, but as signifying an agglomeration of various races united by a common religion. Thus Djafar (who lived in the middle of the 8th century), better known to us as Geber, was a Sabæan. Avicenna, born in 978, was a native of Shiraz. The remarkable geographer and geologist Kazwiny (geology was then a part of alchemy), derived his name from his birthplace, Casbin, in Persia. Mohammed-ben-Zakaria, so celebrated in mediæval Europe under the name of Rhazès, was also a Persian. In Spain, the Jews of the famous school of Saadia and Juda Halevy, exercised considerable influence over the academy of Cordova. Lastly, European historians have systematically exaggerated the ignorance of the Arabs before the time of Mahomet and their intolerance after the establishment of Moslemism, either from the zeal which prompted them to carry on a sort of literary crusade in honor of Christianity, or because in the 18th century they directed against Mahomet attacks which were intended for Christianity itself.

Alchemy received from the Arabians many significant titles. It was the *science of the key*, because it opened all the mysteries of creation, physiology, and medicine; it was the science of the letter M (*misam* is the Arabic for balance), because by means of the balance the gain or loss of all bodies could be determined, even while undergoing chemical combinations. Later on, as is well known, it was by a rigorous and obstinate use of the balance in the hands of Priestley, Cavendish, and Lavoisier, that positive chemistry was founded. Lastly, Rhazès gave to the science of the philosopher's stone a name which plunges us again into the mythological ages of chemistry. He called it the *astrology of the lower world*.

ALCHEMY OF THE MIDDLE AGES.

The care we have taken to note down at the moment of its birth each of the ideas which influenced alchemy, allows us to sketch more rapidly the history of its decline and fall. Albert Groot, commonly known as Albertus Magnus (1193-1280), revived the theory of Geber; and, in spite of the tendencies of the time, entertained the same doubts as his illustrious master on the possibility of transmutation. He is the first to speak of the affinity of bodies, a term he uses in reference to the action of sulphur on metals. He gives the *savans* of the day the sage advice not to take service with princes, who are sure to treat as thieves those who do not succeed. And, indirectly, he warns princes that philosopher's gold is only tinsel. Beginning with nitric acid, which he calls *prime water*, and so on, through a regular series of secondary, tertiary waters, &c., he proposed a method for dissolving all metals. Roger Bacon, while opposing magic, calls *oxygen aer cibis ignis*, and regards the elixir as a sub-

stitute for time, that agent of which nature takes no account. Gold is perfect, because nature has consummated her work. But Roger Bacon seems to have turned his genius principally to physics and mechanism. St. Thomas Aquinas, in his theological writings, forbids the sale of alchemist's gold, and in his special treatise on the subject unmasks an imposture of the charlatans of the day, who pretended to make silver by projecting a sublimate of white arsenic on copper. Further, Aquinas, by reducing the primitive elements of metals to two, revives and corroborates the theory of Galen and Albertus Magnus. About the same time we find a pope, John XXII., and a king, Alphonso X. of Leon and Castile, occupying themselves with alchemy. But the pope in a well-known bull denounced all those searchers for gold "who promised more than they could perform;" another proof that alchemy and the search for gold, though distinguished by the true alchemist, were confounded by many adepts. It is evident that the science, as far as the seeker for gold was concerned, was approaching the times of king John and Philip the Fair, who found in unscrupulous charlatans abettors in their debasement of the currency, and that for disinterested alchemists those evil days were at hand when, disgusted at attaining no practical result, the most serious of them sought in the physiological mysteries of generation, in Adam and Eve, the red man and white woman, of the first chapters of Genesis, what they failed to find in Rhazès, in Geber, and the Arabian Aristotle. The science was still called chemy. It was as a compliment to the Arabian masters, who were still quoted side by side with Genesis, that they added to the word the Arabic article *al*. The popular etymology of the day was likewise Arabic, or, more correctly speaking, Semitic; the Hebrew *chom* or the Arabic *cham* signified heat. Hence their furnaces for heating, the alembics for modifying heat, and the Bains-Marie for imitating the temperature of warm blood; for they could only proceed by analogy. Nevertheless, the great men of the day were the alchemists. The boldness of their actions, the eccentricity of their genius, prove it.

Paracelsus and his Influence.—Tempting as the subject is, we must not linger either on the philosophical doctrine or the medical system of this extraordinary man, for fear of encroaching on the article MEDICINE or the article PARACELSUS. We only wish to show that he is the pioneer of modern chemists, and the prophet of a revolution in general science. Those who only know Bacon in manuals of philosophy are never tired of repeating that the great English philosopher is the father of experimental science. This is true, indeed, in the sense that Bacon insisted with inexhaustible eloquence on the necessity of experimental science, but it is false if it means that Bacon inaugurated modern science by personal experiments. It was this popular conception of Bacon which Liebig attacked, and he thus found no difficulty in drawing up a long and crushing indictment. Bacon was the prophet of experimentation, and this title is sufficient to secure his fame against the abuse of modern dogmatists, who think that science increases little by little, with here a fact and there an idea, without a single pause, a single relapse or revolution. Few take the trouble to consider how far Bacon's philosophy belongs to the past; most are satisfied with cut and dried phrases about the part he played in modern science. Just in the same way, Paracelsus, the great innovator, who thought himself even more enfranchised from the bondage of Aristotle and Galen than he really was, is dispatched with ready-made phrases, but, unlike Bacon, he gets nothing but ridicule and abuse. True alchemy has but one aim and object, to extract the quintessence of things, and to prepare arcana, tinctures and elixirs, which may restore to man the health and soundness he has lost. He beards

the "white-gloved" disciples of Galen, and, in spite of their juleps and draughts, asserts that alchemy is indispensable, and that without it there is no such thing as medical knowledge. He rejects the easy explanation of the universe by means of an entity, stigmatizing it as *paganity*, meaning thereby a necessary consequence of paganism, which, as a theosophist, he holds in abhorrence. He rejects the favorite instrument of the schoolmen, the syllogism. Nature, as he views it, is not a clear and intelligible system of which the form declares the essence; no, it is mysterious. There is a spirit at work beneath the outside shell. What is written on this shell no one can read but the initiated, who have learned to separate the real and the apparent. "At the same time, everything is not active. To separate the active portion (the spirit) of this outside shell from the passive, is the proper province of alchemy."

It is curious to observe that soon after chemistry was established as a science there was a regular deluge of searchers for the philosopher's stone. The limits of this article prevent us from giving a full list of their names. Suffice it to mention, among Frenchmen, De Lisle, who died in the Bastille of the wounds his guardians inflicted on him to extort his secret; among Englishmen, Dr. Price, who committed suicide to escape from a public trial of his pretended discovery. As to the theoretical possibility of making gold, the great French chemist Dumas considered that a solution might be found in the doctrine of isomerism; and the great English chemist Sir Humphrey Davy refused to pronounce that the alchemist must be wrong.

ALCIATI, ANDREA, an eminent Italian jurist, born at Alzano, near Milan, on the 12th January 1492, died 1550. He displayed great literary skill in his exposition of the laws, for which De Thou highly praises him. He published many legal works, and some annotations on Tacitus.

ALCIBIADES was born at Athens about 450 B.C. Through his father, Cleinias, he traced his descent from Eurysaces, the son of Ajax, and through his mother, Deinomache, from Megacles, the head of the Alcmaeonidæ. He was thus related to Pericles, who, after the death of Cleinias at the battle of Coronea (447 B.C.), became his guardian. A youth early deprived of his father's control, possessed of great personal beauty, and the heir to great wealth—a youth consequently universally honored, courted, and caressed—was not in a position to acquire a knowledge of the virtue of self-restraint in any shape or form. Spoilt accordingly by flatteries and blandishments, the boy showed himself self-willed, capricious, and passionate, and indulged in the wildest freaks and most insolent tyrannical behavior. Nor did the instructions of his early manhood supply the corrective which his boyhood lacked. The collection of moral, political, and religious beliefs which the earlier Greeks, from custom, convenience, or the promptings of common sense, had accepted as a standard by which to regulate their own conduct and judge that of others, had been exposed by the sophists to the keenest scrutiny and the widest scepticism. Negative criticism, accompanied with showy novel paradoxes, are always attractive to a young man of intellectual vigor; and thus Alcibiades learnt from Protagoras, Prodicus, and others, to laugh at the common opinions about justice, temperance, holiness, patriotism, &c. The long, patient, laborious thought, the self-sacrificing and comparatively ascetic life of his master Socrates, he was able to admire, but not to imitate or practise. On the contrary, his ostentatious vanity, his amours, his debaucheries, and his impious revels became notorious throughout Athens. But great as were Alcibiades's moral vices, his intellectual abilities were still more conspicuous. He proved his courage at

the battle of Potidea (432 B.C.), where, wounded, he was rescued by Socrates; at the battle of Delium (424 B.C.), where he protected his former deliverer; and on many subsequent occasions. Though he was not a very fluent speaker, he always kept to the point. His energy was immense, his ambition unbounded, but selfish, and provided he could gratify this passion, he never scrupled at the means or the price. He could read the characters of others, and adapt himself to it with a versatility, adroitness, and flexibility which if any even of his shifty fellow-countrymen equalled they never surpassed. Nor were his personal qualities his only recommendation to popular favor. His ancestors and relatives had been for generations the recognized leaders of the people; he had many admirers and followers among the clubs of young nobles; he had numerous dependents who partook of his wealth; and he gratified the populace by the lavish expenditure with which he performed his various liturgical duties. After the battle of Ægospotami, and the establishment of the Spartan supremacy throughout Greece, he crossed the Hellespont, and took refuge with Pharnabazus in Phrygia. There an attack was made upon him, but by whom or for what cause historians are not agreed; his residence was set on fire, and on rushing out on his cowardly assassins, dagger in hand, he was killed by a shower of arrows, 404 B.C.

ALCINOUS, a Platonic philosopher of uncertain date.

ALCINOUS, a mythical king of the Phæacians, in the island of Scheria, wasson of Nausithous, and grandson of Neptune and Peribœa.

ALCIPHRON, the most eminent of the Greek epistolary writers, was probably a contemporary of Lucian. His letters, of which 116 have been published, are written in the purest Attic dialect, and are considered models of style.

ALCIRA, probably the *Satibicula* of the Romans, a Spanish town, on an island in the river Xucar, 24 miles S.W. of Valencia, in the province of that name.

ALCMAN, sometimes also called ALCMÆON, one of the most ancient, and, in the opinion of the Alexandrian critics, the most distinguished of the lyric poets of Greece. According to one account he was by birth a Lydian, while others state that he was a native of Sparta, where, at any rate, he lived from a very early age. The time at which he flourished is uncertain, but it is generally assumed that it embraced the period between the years 670 and 630 B.C..

ALCMENE, the daughter of Electryon, king of Mycenæ, and wife of Amphitryon.

ALCOCK, JOHN, doctor of laws, and bishop of Ely in the reign of Henry VIII., was born in Beverley in Yorkshire before 1440, and educated at Cambridge. He was made dean of Westminster and master of the rolls in 1462. In 1470 he was appointed ambassador to the court of Castile, and 1471 was consecrated bishop of Rochester. In 1477 he was translated to the see of Worcester; and in 1486 to that of Ely. He died October 1, 1500.

ALCOCK, SIR RUTHERFORD, K. C. B., was born in London in 1809; studied medicine at King's College, and became an army surgeon. In 1844 he was sent as British consul to China, was afterward minister to Japan, and from 1865 to 1871 envoy to China. In 1876 he was made president of the Royal Geographical Society.

ALCOHOL, a volatile organic body, constantly formed during the fermentation of vegetable juices containing sugar in solution. It is extracted from spirituous liquors of different kinds by successive distillations or rectifications; the alcohol being more volatile than water, gradually accumulates in the first portion of each distillate. After a few operations the spirit obtained is as strong as it can be made by this process, and further

repetition does not enable us to separate more water from it. In commerce the strongest spirit is known as spirit of wine, and contains about 90 per cent. of alcohol. The remaining 10 per cent. of water must be removed by some chemical agent that will combine with water and retain it at the boiling-point of the spirit, and be without any specific action on the alcohol. The dehydrating substances in general use are certain anhydrous salts, such as carbonate of potash, acetate of potash, or sulphate of copper. These rapidly absorb water at low temperature, and part with it at a red heat; so that they may be used over and over again. The most efficient dehydrating agent is caustic lime or caustic baryta. Lime is generally used in making the absolute alcohol of commerce. For this purpose the caustic lime is broken into small pieces about the size of a walnut, and placed in a retort; spirits of wine is now poured into the vessel, just sufficient to cover the lime, and the whole is left to digest for a night. During this time the lime gradually slakes from the absorption of water, and the anhydrous alcohol is left, ready to distill off at the temperature of the water-bath. Absolute alcohol is a very mobile colorless liquid, having a high refractive power, and possessing a feeble agreeable smell and an acrid, burning taste, which, however, diminishes as it is diluted with water. The caustic taste is in great part due to the rapidity with which it takes water from any living tissue with which it comes in contact, producing coagulation if the fluids are albuminous. Alcohol has a specific gravity of 0.794 at a temperature of 60° Fahr., and boils at 173° ·1 Fahr., barometer being at 30 inches. It does not conduct electricity, and has never been obtained in the solid state, although at very low temperatures it becomes viscid. For this reason alcohol is always used to fill thermometers for registering low temperatures, as mercury freezes, and cannot be employed as an index of temperature below — 39° Fahr. Its high co-efficient of expansion makes alcohol a very sensitive fluid for thermometric purposes. Alcohol has a great tendency to absorb water from the atmosphere, and must be kept in thoroughly sound vessels. It mixes with water in all proportions, and during the dilution there is a considerable amount of heat involved. When alcohol and water are mixed, a contraction of volume occurs, which augments until 100 parts of alcohol are mixed with 116.23 parts of water; 103.775 volumes of alcohol and water mixed in that ratio contracting to 100. Addition of water beyond the proportion given above causes less and less contraction, and finally no diminution of volume can be observed. As alcohol is diluted with water its volatility and its power of dilatation diminish, whereas the specific gravity increases, continually approaching that of water. Next to water, alcohol is the substance most generally employed as a solvent. It dissolves many organic substances, and is especially used in the arts for the manufacture of varnishes. In medicine it is invaluable as a solvent of the active principle of many substances that are insoluble in water, and would soon decompose in aqueous solution. These alcoholic solutions are generally called tinctures. Alcohol is an excellent antiseptic agent. As a preservative of animal structures it is generally used in the impure state—known in commerce as methylated spirit. This is spirits of wine mixed with 10 per cent. of commercial wood spirits, which does not interfere with its preservative or solvent powers, although it renders it unfit for use as a beverage.

Alcohol has the following chemical composition:—

Carbon.....	52.67	per cent.
Hydrogen	12.90	“
Oxygen	34.43	“
	100.00	“

Alcohol, when acted on by other chemical substances, produces a great variety of new compounds. With acids a remarkable class of bodies are produced called ethers, of which ordinary ether is the type. The majority of them are very volatile fluids, that in many cases have a very agreeable odor, and are not readily soluble in water.

As the value of spirituous liquors depends mainly on the quantity of alcohol they contain, it is essential to find some simple and rapid means of ascertaining the percentage amount of the substance present. For this purpose three methods may be employed, viz., specific gravity determination, temperature of ebullition, or rate of expansion. As wines contain many volatile ethers that would pass over with the alcohol in the above process, and interfere with accurate results being obtained, they are generally decomposed by heating with an alkali before the distillation commences.

ALCOY, one of the most thriving manufacturing cities of Spain, on the river Alcoy, in the province of Alicante, 24 miles N.N.W. of the town of that name. A very curious festival is held annually in April in honor of St. George, the patron saint of the town. Population, 32,497.

ALCUDIA, MANUEL DE GODOY, DUKE OF, “Prince of the Peace,” Spanish statesman, was born of poor but noble parentage at Badajoz on the 12th May 1767 (died 1851). In 1784 he came to Madrid to join the royal body-guard, and by his handsome presence and agreeable manners soon attracted notice. The queen regarded him with great favor, and the weak-minded Charles IV. raised him rapidly from dignity to dignity, until in 1792, on the disgrace of Aranda, he became prime minister. One of the first steps he took on his accession to power was to declare war against the French convention. Though success at first attended the Spanish arms, the position of matters was reversed in a second campaign, and the war was concluded by the treaty of Basle, signed on the 22d July 1795, for negotiating which Godoy received his title of Prince of the Peace and a large landed estate. In 1796 he formed an offensive and defensive alliance with the French republic, which involved Spain in a war with England. On the 28th March 1798 he found himself forced to resign his position in the ministry, but he never lost the favor of the king, who appointed him grand admiral in 1799. On the death of his royal master he removed to Paris, where he received a pension of 5000 francs from Louis Philippe. He continued to reside in Paris, where he died October 7, 1851.

ALCUIN, in Latin *Albinus*, surnamed *Flaccus*, an eminent ecclesiastic and a reviver of learning in the 8th century, was born in Yorkshire about 735 (died 804). He was educated at York under the direction of Archbishop Egbert, as we learn from his own letters, in which he frequently calls that prelate his beloved master, and the clergy of York the companions of his youthful studies. He succeeded Egbert as director of the seminary, and in later life modelled after it his famous school at Tours. The emperor contracted so great an esteem and friendship for him that he earnestly urged and at length induced him to take up his residence at court and become his preceptor in the sciences. Alcuin accordingly instructed Charlemagne and his family in rhetoric, logic, mathematics, and divinity. “France,” says one of our best writers of literary history, with some degree of truth, “is indebted to Alcuin for all the polite learning it boasted of in that and the following ages. The universities of Paris, Tours, Fulden, Soissons, and many others, owe to him their origin and increase, those of which he was not the superior and founder being at least enlightened by his doctrine and

example, and enriched by the benefits he procured for them from Charlemagne." Alcuin, it is alleged however, forbade the reading of the classical poets. In 790 he went to England in the capacity of ambassador, and returned to France in 792, never again to visit his native land.

ALCYONIUM, or DEADMEN'S FINGERS, a common coelenterate of the sub-class Actinozoa, belonging to the same order as the sea-pen, the red-coral, etc. It is often found on the coast, in somewhat deep water, as an irregularly lobed mass of white or creamy color, attached to stones and shells. The whole clump, which is perhaps as large as a man's hand (whence the popular name), is not one animal, but contains myriads of individual polyps.

ALCYONIUS, or ALCONIUS, PETRUS, a learned Italian, born at Venice in 1487 (died 1527). Distinguished as a classical scholar, he was employed for some time by Aldus Manutius as a corrector for the press, and in 1522 was professor of Greek at Florence.

ALDAN, a river of Siberia, in the government of Yakutsk. It has a total length of over 500 miles, for a considerable part of which it is navigable.

ALDAN MOUNTAINS, the name usually applied to a branch of the Stanovoi mountains, which strikes off from the main chain in the direction of Aldan river.

ALDBOROUGH, a town of England, in the West Riding of Yorkshire, 16 miles west-northwest of York.

ALDEBARAN, the Arabic name of a star of the first magnitude in the constellation Taurus. It is the largest and most brilliant of a cluster of five known to the Greeks as the Hyades.

ALDEBURGH, or ALDBOROUGH, a market-town and watering-place in the county of Suffolk, England, twenty-five miles east-northeast of Ipswich. Pop., 3,800.

ALDEGREVER, or ALDEGRAF, HEINRICH, a German painter and engraver, born in 1502 at Paderborn, from which he removed in early life to Soest. Aldegrevier died about the year 1562.

ALDEHYDE, CH₃COH, is a volatile fluid produced by the oxidation and destructive distillation of alcohol and other organic compounds. It mixes in all proportions with water, alcohol and ether, and dissolves sulphur, phosphorus and iodine.

ALDER, a genus of plants (*Alnus*) belonging to the order *Betulaceæ*, the best known of which is the common alder (*A. glutinosa*). This tree thrives best in moist soils, has a shrubby appearance, and grows, under favorable circumstances, to a height of forty or fifty feet.

ALDERMAN, a word derived from the Anglo-Saxon *ealdorman*, compound of the comparative degree of the adjective *eald* (old) and *man*. The term implies the possession of an office of rank or dignity. In modern times aldermen are office-bearers in the municipal corporations of England and Wales, and Ireland. In the United States aldermen form as a rule a legislative rather than a judicial body, although in some cities they hold courts and possess considerable magisterial powers.

ALDERNEY, one of the Channel Islands, and the most northerly of the four, lies 7 miles to the westward of Cape la Hogue, and is separated from the French coast by a narrow channel called the race of Alderney. The passage through this straight is rendered very dangerous in stormy weather by its conflicting currents; but through it the scattered remnant of the French fleet under Tourville succeeded in escaping after the defeat of La Hogue in 1692. The harbor of Alderney is 20 miles distant from St. Peter Port, Guernsey, 45 miles from St. Helen's, Jersey, and 60 miles from Portland Bill, the nearest point of England. There is regular steam communication with Guernsey. The length of the island from N.E. to S.W. is 3½ miles; its width

about 1 mile; its greatest elevation is 280 feet; and the area is about 4 square miles.

The greater part of Alderney is a level table-land, more or less cultivated. The land continues flat to the edge of the south-eastern and southern cliffs, which present a magnificent succession of broken and perpendicular walls of rock. Towards the north-west, north, and east, the coast is less rocky, and is indented by several bays of tame and naked aspect, of which those of Crabby, Braye, and Longy are the most noticeable.

The population of Alderney has increased somewhat of recent years on account of the extensive public works. In 1891 it was only 1,857, in 1901 it was 2,062. The inhabitants are Protestants, and Alderney forms part of the diocese of Winchester. Though a French *patois* lingers in the island, English is generally spoken and universally understood. The climate is healthy, and there is abundance of good water.

Alderney seems to have been known to the Romans as *Riduna*, and Roman as well as Celtic remains have been discovered. It is subject to the British crown, and is a dependency of Guernsey. For its history and relation to English legislation, see the article on the CHANNEL ISLANDS.

ALDERSHOT CAMP, an English garrison for a large force, situated about 35 miles from London, on the confines of Hampshire and Surrey. It was established in May 1855, and was intended as a military training school, especially for officers of the higher grades. Its germ is to be found in the temporary camp on Cobham Ridges, formed in 1853 by Lord Hardinge, then commander-in-chief, the success of which convinced him of the necessity of giving the troops practical instruction in the field, and affording the generals opportunities of manœuvring large bodies of the three arms. He therefore advised the purchase of a tract of waste land whereon a permanent camp might be established. His choice fell on Aldershot, a spot also recommended by strategic reasons, being so placed that a force holding it covered the capital.

ALDHELM, or ADELM, St., Bishop of Sherborne in the time of the Saxon heptarchy, was born about the middle of the 7th century. He is said to have been the son of Kenred, brother to Ina, King of the West Saxons; but in the opinion of William of Malmesbury, his father was no more than a distant relation to the king. Having received the first part of his education in the school of Meildulf, a learned Irish monk, he traveled in France and Italy for his improvement. On his return home he studied some time under Adrian, abbot of St. Augustin's in Canterbury, the most learned professor of the sciences who had ever been in England. The fame of his learning soon spread, not only in England, but in foreign countries. He was a musician as well as a poet, and made his own songs the medium of instruction and refinement to his barbarous countrymen. After having governed the monastery of Malmesbury, of which he was the founder, about thirty years, he was made bishop of Sherborne, where he died in May 799.

ALDINE EDITIONS. See MANUTIUS.

ALDINI, GIOVANNI, a distinguished physicist, born at Bologna on the 10th April 1762 (died 1834), was the nephew of Galvani, and brother of the statesman Count Antonio Aldini. Devoted from his youth to the study of natural science, he was chosen in 1798 to succeed his former teacher Canterzani in the chair of physics at Bologna. He left by will a considerable sum to found a school of natural science for artisans at Bologna.

ALDRED, EALDRED, or ALDRED, a prominent ecclesiastic in the 11th century, was successively abbot of Tavistock, bishop of Worcester, and archbishop of

York. He died at York, Sept. 11, 1069, of grief, it is said, because of the threatened attack on his city by the combined forces of the English and Danes.

ALDRICH, Dr. HENRY, theologian and philosopher, was born in 1647 at Westminster, and was educated at the collegiate school there, under Dr. Busby. In 1662 he entered Christ Church College, Oxford, with which he continued to be intimately connected during his whole life. He took so conspicuous a part in the controversy with the Roman Catholics during the reign of James II., that at the Revolution the deanery of Christ Church was conferred upon him, Massey, the popish dean, having fled to the continent. In 1702 he was appointed rector of Wem in Shropshire, but continued to reside at Oxford, where he died on the 14th Dec. 1710.

ALDROVANDI, ULISSE, a celebrated naturalist, born of noble parentage at Bologna on the 11th Sept. 1522 (died 1607). While a boy he was page in the family of a rich bishop, and afterwards apprentice to a merchant in Brescia. Commercial pursuits soon became distasteful to him, and he turned his attention to law and medicine, studying first in his native town and afterwards at Padua. In 1550, having been accused of heresy, he was compelled to proceed to Rome in order to vindicate himself before the Inquisition, which gave him a conditional acquittal. In Rome he published his first work, a treatise on ancient statuary. Here he made the acquaintance of the eminent naturalist Rondelet, from whom it seems not unlikely that he derived the impulse towards what became from that time his exclusive study. On his return to Bologna he devoted himself specially to botany, under the teaching of Lucas Ghino, then professor of that science at the university. In 1553 he took his doctor's degree in medicine, and in the following year he was appointed professor of philosophy and also lecturer on botany at the university. In 1560 he was transferred to the chair of natural history, which he continued to occupy until rendered infirm by age.

ALDSTONE, or ALSTON MOOR, a market-town of England, in the county of Cumberland, situated on an eminence near the South Tyne, 19 miles E.S.E. from Carlisle, with which it is connected by railway. Population (1889) of parish, 7800; of town, 3500.

ALE, a fermented liquor obtained from an infusion of malt, and differing from beer chiefly in having a less proportion of hops. Before the introduction of hops into England from Flanders, about 1524, ale was the name exclusively applied to malt liquor, the term beer being gradually introduced at a later period to describe liquor brewed with an infusion of hops. Ale, the wine of barley, is said to have originally been made in Egypt. The natives alike of Spain, France, and Britain all use an infusion of barley for their ordinary liquor, which was called *calia* and *ceria* in the first country, *cerevisia* in the second, *curmi* in the third—all literally importing *the strong water*.

This ale was most commonly made of barley, but sometimes of wheat, oats, and millet. Ale was the favorite liquor of the Anglo-Saxons and Danes. Before their conversion to Christianity, they believed that drinking large and frequent draughts of ale was one of the chief felicities which those heroes enjoyed who were admitted into the hall of Odin.

For details as to the processes of manufacture and other points, see **BREWING**.

ALE-CONNER, an English officer appointed at the courtlet of ancient manors for the assize of ale and ale-measures. The *gustatores cervisia*—called in different localities by the different names, "ale-tasters," "ale-founders," and "ale-conners"—were sworn to examine beer and ale, to take care that they were good and whole-

some and were sold at proper prices. (For the means employed to test the quality of ales, see **ADULTERATION**.)

ALEANDRO, GIROLAMO (HIERONYMUS), cardinal, commonly called the "Elder," to distinguish him from his grand-nephew of the same name, was born at Motta, near Venice, on the 13th of February, 1480 (died 1542). He studied at Venice, and, while still a youth, acquired great reputation for learning. In 1508 he went to Paris, on the invitation of Louis XII., as professor of belles lettres, and he held for a time the position of rector in the university. In 1538 Paul III. conferred upon him the cardinal's hat, when he took the title of St. Chrysogonus. He died at Rome on the 31st January or 1st February 1542.

ALEMAN, LOUIS, Archbishop of Arles, and Cardinal of St. Cecilia, was born at Bugey in 1390. He was one of the presidents of the Council of Basle in 1431, and led the party that maintained the supremacy of councils over popes in opposition to the claims of Eugenius IV. In 1527 Aleman was canonised by Pope Clement VII.

ALEMANNI, a large German tribe on the Upper Rhine. They are first mentioned by Dion Cassius, who relates that the Emperor Caracalla gained, in 213 A.D., a victory over them on the banks of the Maine, and thence assumed the surname *Alemannicus*. The origin of this tribe, and the country from which they came, are unknown; but we have a distinct statement, which is apparently confirmed by the very name of the people, that they had flocked together from all parts, and were a mixed race. They proved most formidable enemies to the Romans as well as to the Gauls, their western neighbors, who to this day apply the name Alemanni (Allemands) to all the Germans indiscriminately, though the Alemanni, properly so called, occupied only the country between the Maine and the Danube. In these countries the Alemanni have maintained themselves ever since, and the greater part of the modern Suabians and the northern Swiss are descendants of that ancient race.

ALEMBIC, an apparatus for distillation, used chiefly by the alchemists, and now almost entirely superseded by the retort and worm-still.

ALEMTEJO (Spanish *Alentejo*), a province of Portugal, bounded on the N. by Beira, on the E. by Spanish Estremadura and Andalusia, on the S. by Algarve, and on the W. by the Atlantic and Portuguese Estremadura. It has an area of 9,381 square miles. The chief towns are Evora, Portalegre, Elvas, Beja, Estamoz, and Moura. There are no seaports of importance in the province. Population in 1889, 380,000.

ALENÇON, the chief town of the French department of Orne, situated in a wide and fertile plain, on the Sarthe, close to its confluence with the Briante. The lace known as the "point d'Alençon" is the most noted manufacture of the town, although of late years its importance has somewhat diminished. Among other industries are tanning, spinning, bleaching, linen manufacturing, and cider-making. The cutting of quartz crystals, often called Alençon diamonds, is also carried on. Population (1902), about 20,000.

ALenio, GIULIO, a missionary of the Jesuit order, born at Brescia 1582, died 1649. He became a member of the order in 1600, and arrived at Macao as a propagandist in 1610. He composed a number of works in the Chinese language, of which he was thoroughly master, the most important being a *Life of Christ* and a *Cosmography*.

ALEPPO, or HALEB, a city of Syria, capital of the Turkish vilayet of the same name, near the N.W. extremity of the great Syrian desert. It occupies the site of the ancient *Beraa*, and is a place of great antiquity. After the destruction of Palmyra it speedily became the

great emporium of the trade between the Mediterranean and the countries of the East. It was overwhelmed by the flood of Saracen invasion in 638, and in 1260, and again in 1401, it was plundered and laid waste by the Tartars. It finally came into the possession of the Turks in 1517. To the east of the modern city extensive remains of its ancient grandeur have been discovered.

Formerly Aleppo stood in the first rank among the cities of Asia Minor as a place of trade; and it is still the emporium of Northern Syria, and has extensive commercial relations with Diarbekir and the upper parts of Anatolia, and also with Mosul and Baghdad. Large caravans resort to Aleppo from these and other eastern places, and the imported foreign goods are brought by caravans from the ports of Scanderoon or Alexandretta and Latakia. The construction of a carriage-road between Aleppo and Alexandretta was commenced. Its completion was very slow and long delayed. Trade is conducted in Aleppo by more than 100 mercantile houses, several of them British; but no commercial bank has as yet been established in the province. The principal manufacture of the city consists of various kinds of cloth, of silk, cotton, and wool, some flowered and striped, others woven with gold and silver thread. These cloths have long been famous throughout the East, and the manufacture of them employs about 6400 looms. A large amount is invested in the manufacture of carpets, cloaks, and girdles. There are, besides, numerous soap, dyeing, and print works, and also ropewalks. In addition to cloths, the exports include wheat, sesame, wool, cotton, oil, scammony, galls, pistachionuts, camels' hair, &c.; while the imports chiefly consist of European manufactured goods and colonial produce.

The air of Aleppo is dry and piercing, but not insalubrious. The city, however, as well as the environs, is subject to a singular epidemic disorder called the boil of Aleppo.

By the visitations of the plague, the earthquakes, the cholera of 1832, and the oppression of the Egyptians while Syria was subject to Mehemet Ali, the population of Aleppo has been much reduced. In the earlier part of the century the inhabitants numbered over 200,000; but the population is now estimated at less than 128,000, of whom 15,500 are Christians, 4000 Jews and the remainder mostly Mahometans.

ALES, or ALESS (ALESIUS), ALEXANDER, a celebrated divine of the school of Augsburg, was born at Edinburgh on the 23d April 1500 (died 1565). His name was originally Alane, and that by which he is more generally known (derived from *ἀλεξίνω*) was assumed by him when he went into exile. He studied at St. Andrews in the newly founded college of St. Leonards, where he graduated in 1515. Some time afterwards he was appointed a canon of the collegiate church, and in this office he at first contended vigorously for the scholastic theology as against the doctrines of the Reformers. His views were entirely changed, however, on the occasion of the execution of Patrick Hamilton in 1528. After travelling in various countries of northern Europe, he settled down at Wittenberg, where he made the acquaintance of Melancthon, and signed the Augsburg confession. Meanwhile he was tried in Scotland for heresy, and condemned without a hearing. In 1533 a decree of the Scottish clergy, prohibiting the reading of the New Testament by the laity, drew from Alesius an ably-argued defence of the right of the people, in the form of a letter to James V. A reply to this by John Cochlaeus, also addressed to the Scottish king, occasioned a second letter from Alesius, in which he not only restates and amplifies his argument with great force and beauty of style, but enters at some length into more general ques-

tions connected with the Reformation. In 1535, Henry VIII. having broken with the Church of Rome, Alesius was induced to remove to England, where he was very cordially received by the king and his advisers, Cranmer and Cromwell. In 1539 Alesius was compelled to flee for the second time to Germany, in consequence of the enactment of the persecuting statute known as the Six Articles. At Leipsic Alesius remained until his death, which occurred on the 17th of March, 1565.

ALESIA, a town of ancient Gaul, situated on a lofty hill, and famous as the place where Julius Caesar besieged and defeated Vercingetorix, at the head of 80,000 Gauls. The city was destroyed by the Normans in 864. It was situated near the present city of Dijon.

ALESSANDRI, ALESSANDRO (*Alexander ab Alessandro*), a learned juriconsult, born at Naples about the year 1461 (died 1523). He studied at Naples and Rome, and afterward practiced for a time as advocate in both cities. At Naples he is said to have been royal prothonotary in 1490.

ALESSANDRIA, a province of Italy, in the former duchy of Piedmont, bounded on the north by Novara, on the east by Pavia, on the south by Genoa, and on the west by Turin; with an area of 1,951 square miles. Population, (1901), 812,022.

ALESSANDRIA, a city of Italy, the capital of the above province, is situated in a marshy district near the confluence of the Tanaro and the Bormida. It is a strongly fortified place, its citadel, on the left bank of the Tanaro, being one of the most important in Europe. The town itself, which lies chiefly on the right bank of the river, is the seat of a bishop, and contains a cathedral and more than a dozen other churches, besides monasteries and nunneries. The principal manufactures of Alessandria are silk, linen, and woollen goods, stockings, and hats. Large quantities of fruit and flowers are also produced in the neighborhood. Near Alessandria is Marengo, where Napoleon defeated the Austrians in 1800. Population (1901), 71,293.

ALESSI, GALEAZZO (1500-72), a distinguished architect, born at Perugia, was a pupil of Caporali.

ALETSCHE, the largest glacier in Europe, which sweeps round the southern side of the Jungfrau. It is twelve and one-half miles in length.

ALEUTIAN ISLANDS, so called from the Russian word *aleut*, signifying a bold rock, is the name given by the Russian discoverers to a chain of small islands situated in the Northern Pacific Ocean and extending in an eastern direction from the peninsula of Kamtchatka, in Asiatic Russia, to the promontory of Alaska, in North America. This archipelago has been sometimes divided into three groups; the islands nearest Kamtchatka being properly called Aleutia, the central group the Andreanov or Andrenovian, and those nearest to the promontory the Fox Islands. The population of the whole group is about 8,000, the natives being a kindred race to the inhabitants of Kamtchatka. They are described as rather low in stature, but plump and well-shaped, with short necks, swarthy faces, black eyes, and long straight black hair. They have nominally been converted to Christianity by the missionaries of the Greek Church, but are said to be unchaste in their habits, and addicted to intemperance.

ALEWIFE (*Alosa tyrannus*), a fish of the same genus with the SHAD (*q.v.*), which in the end of spring and beginning of summer appears in great numbers on the eastern coast of North America and enters the mouths of rivers to spawn. The alewife, which is not more than twelve inches long, is called *spring herring* in some places and *gasperau* in Canada. The fish, salted, is exported in large quantities to the West Indies.

ALEXANDER III., commonly called "The Great,"

son of Philip II., king of Macedonia, and of Olympias, daughter of the Molossian chief Neoptolemus, was born at Pella, 356 B.C. His father was a man of fearless courage and the soundest judgment; his mother was a woman of savage energy and fierce superstition. Alexander inherited the qualities of both his parents, and the result was the combination of a boundless ambition with the most sober practical wisdom. The child grew up with the consciousness that he was the heir of a king whose power was rapidly growing; and the stories told of him attest at least the early awakening of a mind formed in the mould of the heroes of mythical Hellas. Nay, the blood of Achilles was flowing, as he believed, in his veins; and the flattery of his Acarnanian tutor Lysimachus, who addressed him as the son of Peleus, may have strengthened his love of the immortal poems which told the story of that fiery warrior. By another tutor, the Molossian Leonidas, his vehement impulses were checked by a wholesome discipline. But the genius of Alexander, the greatest of military conquerors, was moulded in a far greater degree by that of Aristotle, the greatest conqueror in the world of thought. At the age of thirteen he became the pupil of a man who had examined the political constitutions of a crowd of states, and who had brought together a vast mass of facts and observations for the systematic cultivation of physical science. During these three years the boy awoke to the knowledge that a wonderful world lay before him, of which he had seen little, and threw himself eagerly, it is said, into the task of gathering at any cost a collection for the study of natural history. While his mind was thus urged in one direction, he listened to stories which told him of the great quarrel still to be fought out between the East and the West, and learnt to look upon himself as the champion of Hellas against the barbarian despot of Susa.

The future conqueror was sixteen years of age when he was left at home as regent while his father besieged Byzantium and Perinthus. Two years later the alliance of Thebis and Athens was wrecked on the fatal field of Chæronea, where Alexander, now eighteen years of age, encountered and overcame the Sacred Band which had been foremost in the victories of Leuctra and Mantinea (see EPAMINONDAS); but the prospects of Alexander became now for a time dark and uncertain. Philip had divorced Olympias and married Cleopatra, the daughter of Attalus. This act roused the wrath not only of Olympias, but of her son, who with her took refuge in Epirus. Cleopatra became the mother of a son. Her father, Attalus, rose higher in the king's favor, and not a few of Alexander's friends were banished. But the feuds in his family were subjects of serious thought for Philip, who sought to counteract their ill effects by a marriage between his daughter and her uncle, the Epirot king Alexander, the brother of Olympias. The marriage feast was celebrated at Æge. Clothed in a white robe, and walking purposely apart from his guards, Philip was approaching the theatre when he was struck down by the dagger of Pausanias.

Alexander was now eager to carry out his great design against Persia; but he could not do so with safety until he had struck a wholesome terror of his power into the mountain tribes which hemmed in his dominions. His blows descended swiftly and surely on the Thracians of Mount Hæmus (*the Balkan*), on the Triballians, and on some clans of Getæ, whom he crossed the Danube to attack. But these expeditions led him away from the world of the Greeks. Silence led to rumors of his defeat, and the rumors of defeat were followed by more confident assertions of his death. At Thebes and at Athens the tidings were received by some with eager

belief. The covenant made with Alexander was made only with him personally. The Theban exiles at Athens were anxious to repeat the attempt which half a century earlier had been made against the Spartan garrison of the Cadmea by Pelopidas. With help in arms and money from Demosthenes and other Athenians, they entered Thebes, and summoned the Macedonian garrison to surrender. The answer was a blunt refusal, and a double line of circumvallation was drawn around the citadel, while envoys were sent to call forth aid from every quarter; but these efforts could not affect the issue. The belief in Alexander's death was to be dispelled, by no gradual reports of his escape from the barbarians, but by his own sudden appearance at the Boeotian Onchestus. He had just defeated the Illyrians when he heard of the revolt, and he determined to smite the rebels without turning aside to take even a day's rest at Pella. In little more than a fortnight his army was encamped on the southern side of Thebes, thus cutting off all chances of aid from Athens. It was his wish to avoid an assault, and he contended himself with demanding the surrender of two only of the anti-Macedonian leaders. The citizens generally were anxious to submit, but the exiles felt or feared themselves to be too deeply committed; and the answer took the form of a defiance, accompanied by a demand for the surrender of Antipator and Philotas. They had sealed their own doom. Personal bravery was of no use against the discipline, the numbers, and the engines of the enemy. The defenders were driven back into the city; the invaders burst in with them; and the slaughter which followed was by no means inflicted by the Macedonians alone. The Platæans, Thespians, and Orchomenians felt that they had old scores to settle. To these and to the rest of his Greek allies Alexander submitted the fate of the city. The sentence was promptly pronounced. The measure which the Thebans had dealt to Plataeæ, and would have dealt to Athens, should now be dealt out to themselves. The whole town was razed to the ground, the house of the poet Pindar being alone spared from demolition, and his descendants alone allowed to retain their freedom. Alexander had gained his end. The spirit of the Greeks was crushed; a great city was blotted out, and the worship of its gods was ended with its ruin. Without turning aside to Athens, he went on to Corinth to receive the adulations of the independent Greeks, and to find, it is said, a less courtly speaker in the cynic Diogenes. From Corinth he returned to Macedonia, having left Greece for the last time.

Six months later he set off from Pella, crossed the Hellespont at Sestus, to appease at Ilium by a costly sacrifice the wrath of the luckless Priam; and then marched on, with not more perhaps than 30,000 infantry and 4000 cavalry, and with a treasure-chest almost empty, to destroy the monarchy of Cyrus. With him went men who were to be linked with the memory of his first crimes and of his most astonishing triumphs — Clitus, Hephæstion, Eumenes, Seleucus, Ptolemy, the son of Lagos, and Parmenion, with his sons Philotas and Nicanor. The effects of Macedonian discipline were to be seen at once on the banks of the Granicus, a little stream flowing to the Propontis from the slopes of Ida. Losing, it is said, only 60 of his cavalry and 30 of his infantry, he annihilated the Persian force, 2000 out of 20,000 foot soldiers being taken prisoners, and nearly all the rest slain. The terror of his name did his work, as he marched southwards. The citadel of Sardis might with ease have been held against him; before he came within eight miles of the city, the governor hastened to surrender it with all its treasure. At Ephesus he found the city abandoned by its garrison.

Miletus he carried by storm. Before Halicarnassus he encountered a more obstinate resistance from the Athenian Ephialtes; but the generalship of the latter was of no avail. Alexander entered Halicarnassus, and the Rhodian Memnon remained shut up in the citadel. Leaving Ptolemy with 1000 men to blockade it, he spent the winter in conquering Lycia, Pamphylia, and Pisidia, ending his campaign at Gordium, on the river Sangarius. Here was preserved the ancient waggon of Gordius, the mythical Phrygian king. Whoever could untie the knot, curiously twisted with fibres of the cornel tree, which fastened its pole to the yoke, was, so the story ran, to be lord of Asia. Alexander, as much at a loss as others to unloose it, cut it with his sword; but the prophecy was none the less held to be fulfilled. If he was thus favored by sentiment, he was still more favored by the infatuation which led Darius to abandon the policy of defence by sea for offensive warfare by land. From all parts of his vast empire was gathered a host, numbering, as some said, 600,000 men; and the despot was as much elated at the sight as Xerxes, when he looked down upon his motley multitudes at Doriscus. Like Xerxes he had one (Athenian Charidemus) by his side to warn him that Asiatic myriads were not to be trusted in an encounter with the disciplined thousands of Alexander; but he lacked the generosity which made Xerxes dismiss Demaratus with a smile for his good-will. Darius seized the exile with his own hand, and gave him over to the executioner. "My avenger," said Charidemus, "will soon teach you that I have spoken the truth." The Persian acted as though he wished to bring about the speediest fulfilment of the prediction. The Greek mercenaries were withdrawn from the fleet to be added to the land forces; but although a hundred of these could have effectually barred the passage of Alexander across the range of Taurus, and the passes of the Amanian, Cilician, and Assyrian gates, the invader was suffered to cross these defiles without the loss of a man. Nay, so great was the contempt of Darius for the few thousands of the enemy, that he wished to give them a free path until they reached the plain from which he would sweep them away. But he could not wait patiently for them in his position to the east of the Amanian range. Alexander had been ill, and he had work to do in subjugating western Cilicia. When at length he set out on his march to the southern Amanian pass, Darius, with his unwieldy train crossed the northern pass, and entered Issus two days after Alexander had left it. He had placed himself in a trap. In a space barely more than a mile and a half in width, hemmed in by the mountains on the one side and the sea on the other, Darius, in his royal chariot, in the midst of multitudes who had scarcely room to move, awaited the attack of Alexander, who fell suddenly on his right wing. The first onset was enough. The Persians broke and fled. Darius, thinking himself in danger, fled among the foremost. The Persian centre behaved well; but it mattered little now what they might do. Even the Greek mercenaries were pushed back and scattered. Four thousand talents filled the treasure-chest of the conqueror, and the wife, mother, and son of Darius, appearing before him as prisoners, were told that they should retain their royal titles, his enterprise being directed, not against Darius personally, but to the issue which was to determine whether he or Alexander should be lord of Asia.

The true value of armed Asiatic hordes was now as clear to all as the sun at noonday. Parmenion advanced to attack Damascus, but he needed not to strike a blow. The governor allowed the treasure in his charge to fall into his hands, and then surrendered the city. Alexander himself marched southward to Phoenicia. At

Marathus, he replied to a letter in which Darius demanded the restoration of his family and reproached him for his wanton aggression. His answer repeated what he had already said to his wife, adding that, if he wrote again, Darius must address him, not as his equal, but as his lord. "I am now master of Asia," he wrote, "and if you will not own me as such, I shall treat you as an evil-doer. If you wish to debate the point, do so like a man in the battlefield. I shall take care to find you wherever you may be." The island city of Aradus was surrendered on his approach. Sidon opened her gates. From the Tyrians he received a submission which demurred only to his entering their city. A siege of seven months ended in its fall; and Alexander hanged 2,000 of the citizens, it is said, on the sea-shore. The survivors, with the women and children, were sold as slaves. Alexander's face was turned towards Egypt. Gaza dared to resist; but a siege of two months was followed by a ruin as complete as that of Tyre. From Gaza a march of seven days brought him to Pelusium. The Persian governor opened its gates to receive him; and the Egyptians expressed their delight at exchanging a Persian for a Macedonian master. Marching in triumph to Memphis, he offered solemn sacrifice to the calf-god Apis; and then, with the true instinct of the ruler and the statesman, he hastened to found for his new kingdom a new capital, which, after more than two millenniums, remains a highway for the commerce of three continents.

Marching back through Phoenicia, he hastened to Thapsacus, and then crossed the Euphrates. Thence turning northward, he made a sweep which brought him to the Tigris, below Nineveh (*Mosul*), and there, without opposition, crossed a stream where the resistance of a few hundreds might have destroyed his army. After a few days' march to the south-east, he received the news that Darius, with all his host, was close at hand. Still convinced that mere numbers must, with ample space, decide the issue of any fight, and attributing his defeat at Issus only to the cramped position of his troops, he had gathered a vast horde, which some represent at more than a million, on the broad plain stretching from Gaugamela eastward to Arbela. His hopes were further raised by changes made in the weapons of his troops, and more especially in the array of his war-chariots. For the Macedonians, it is enough to say that they were led by a man whose consummate generalship had never shone more conspicuously than in the cautious arrangements which preceded the battle of Arbela, or rather of Gaugamela. All went as he had anticipated. As at Issus, Darius fled; and the bravery and even gallantry of the Persians opposed to Parmenion were of no avail when the main body had hurried away after the king. So ended the last of the three great battles (if such they may be termed) which sufficed to destroy the Persian empire, or rather to make Alexander king of Persia; and so ended the first act of the great drama of his life.

For a month Alexander allowed his main army to rest near Persepolis; for himself there could be no repose. With his cavalry he overran, and, in spite of the rigors of winter, subdued the whole region of Farsistan. Then returning to Persepolis, he set forth on his march to Media, where the fugitive king had hoped to be safe from his pursuit. Darius had left Agbatana (Ecbatana) eight days before his pursuer could reach it. In this ancient fastness of the Median and Persian sovereigns Alexander deposited his treasure, exceeding, we are told, forty millions sterling in amount, under the charge of a strong Macedonian garrison headed by Parmenion. He then hastened on towards the Caspian gates, and learnt, when he had passed them, that Darius

had been dethroned, and was now the prisoner of the Bactrian satrap Bessus. The tidings made Alexander still more eager to seize him. His effort was so far successful that Bessus felt escape to be hopeless unless Darius could be made to leave his chariot and fly on horseback. He refused to obey, and was left behind, mortally wounded. Before Alexander could reach him, he was dead.

The conqueror now regarded, or professed to regard, himself as the legitimate heir and successor of Xerxes. His course of conquests was still unbroken; but successful forays against the Mardians on the northern slopes of Mount Elburz, against the Arians of modern Herat, and the Drangians of the present Seistan, were followed by an exploit of another sort. The autumn and winter were spent in overrunning parts of the modern Afghanistan and Cabul, in the formation of the Caucasian Alexandria, and in the passage of the Hindu-Kush. He was now in the satrapy of Bessus. The surrender of Aornus and Bactria was followed by the passage of the Oxus and by the betrayal of Bessus, who was sent naked and in chains to the city which had been his capital. The winter was spent in the Bactrian city of Zariaspa, where Alexander, summoning Bessus before him, had his ears and nose cut off, and then sent him to be killed by his countrymen at Ecbatana.

The next river to be crossed was the Indus. The bridge was constructed by Hephæstion and Perdicas, probably near the present Attock. The surrender of Taxila left Alexander an open path until he reached the Hydaspes (*Jhelum*), where Porus was beaten only after a severe struggle. The Indian prince was taken prisoner, and treated with the courtesy which the family of Darius had received after the battle of Issus. Here died Alexander's horse Boukephalos (Bucephalus), and the loss was commemorated by the founding of Bucephalia. The passage of the Acesines (*Chenab*), running with a full and impetuous stream, was not accomplished without much danger; that of the Hydraotes (*Ravee*) presented less formidable difficulties, but he was encountered on the other side by Indians, who entrenched themselves in their town of Sangala. Their resistance ended, it is said, in the slaughter of 17,000 and the capture of 70,000. About 40 miles further to the south-east flowed the Hyphasis (*Sutlej*). Alexander approached its bank, the limit of the Panjab, in the full confidence that a few days more would bring him to the mighty stream of the Ganges; but he had reached the goal of his conquests. The order for crossing the river called forth murmurs and protests at once from his officers and his soldiers, who expressed plainly their refusal to march they knew not whither. Alexander in vain laid before his officers his scheme of further conquest; and when he offered the sacrifice customary before crossing a river, the signs were pronounced to be unfavorable. The die was cast. Twelve huge altars remained to show that Alexander had advanced thus far on his conquest of the world; and, in the midst of deluges of rain, the army set out on its westward journey. From the mouth of the Indus he ordered his admiral Nearchus to take the fleet along the shores of the ocean and the Persian Gulf to the mouth of the Tigris. The army marched by land through the Gedrosian desert, suffering more from thirst and sickness than they had suffered in all their battles and forced marches. At length he reached Pasargadæ, to find the tomb of Cyrus broken open and plundered, and to avenge the insult offered to the man whom he now regarded as the founder of his own dynasty. Early in the following year he entered Susa, and there, celebrating his marriage with Statira, the daughter of Darius and of Parysatis the daughter of his predecessor Ochus, he offered

to pay the debts of those soldiers who would follow his example by taking to themselves Persian wives—a strange mode of inviting sober and steady men who had no debts, but an effectual argument for the spendthrifts and ruffians of his army. His new levies of Persian youths, armed and disciplined after the Macedonian fashion, had now made him independent of his veteran soldiers; and his declared intention of sending home the aged and wounded among them called forth the angry remonstrances of their comrades, who bade him complete his schemes of conquest with the aid of father Ammon. Alexander rushed into the throng, seized some and had them executed, and then disbanded the whole force. For two days he shut himself up in his palace; on the third he marshaled his Persian levies (*Epigoni*, as he called them) into divisions bearing the Macedonian military titles, under Persian officers. The spirit of the veterans was broken by this ignoring of their existence. They threw down their arms at the palace gates, and begged forgiveness with cries and tears. Alexander accepted their contrition, and the restoration of harmony was celebrated by a sumptuous sacrifice.

But for Alexander past victories were only a stimulus to further exploits. Arabia still remained unsubdued, and for this conquest a large addition was needed to his fleet. Orders were sent to Phœnicia for the construction of ships, which were to be taken to pieces and sent overland to Thapsacus on the Euphrates, while others were to be built at Babylon. His march to Babylon steeped him still more in the intoxication of success. As he advanced on his road he was met by ambassadors not only from Illyrians and Thracians, from Sicily and Sardinia, from Libya and Carthage, but from Lucanians and Etruscans, and, as some said, from Rome itself. The lord of all the earth could scarcely look for wider acknowledgment or more devout submission; but his self-gratulation may have been damped by the warning of the Chaldean priests that it would be safer for him not to enter the gates of Babylon. For a while he hesitated, but he had more to do than to heed their words. The preparations for his Arabian campaign must be hurried on; all that might be needed must be done to improve the navigation of the Euphrates, and a new city must be built to rival, perhaps, the Alexandria which he had founded by the banks of the Nile. More than all, he had to celebrate the obsequies of Hephæstion, whose body had been brought to Babylon from Ecbatana. The feasting which everywhere accompanied the funeral rites of the ancient world was exaggerated by the Macedonians, as by other half rude or savage tribes, into prolonged revelry. Alexander spent the whole night drinking in the house of his friend Medius, and the whole of the next day in sleeping off his drunkenness. Throughout the following night the same orgies were repeated. When he next awoke he was unable to rise. Fever had laid its grasp upon him, and each day its hold became tighter, while he busied himself incessantly with giving orders about his army, his fleet, his generals, until at length the powers of speech began to fail. When asked to name his successor, he said that he left his kingdom to the strongest. His signet-ring he took from his finger and gave to Perdicas. Throughout the army the tidings of his illness spread consternation; old grudges were all forgotten; his veterans forced themselves into his presence, and with tears bade farewell to their general, who showed by signs that he still knew them. A few hours later Alexander died, after a reign of less than thirteen years, and before he had reached the age of thirty-three.

ALEXANDER OF APHRODISIAS, the most celebrated of Greek commentators on the writings of Aris-

tole, and styled, by way of pre-eminence, the *Expositor*. He was a native of Aphrodisias in Caria, and taught the Peripatetic philosophy at Athens in the end of the 2d and beginning of the 3d centuries of the Christian era. Commentaries by Alexander on the following works of Aristotle are still extant:—The *Analytica Priora*, I.; the *Topica*; the *Meteorologica*; the *De Sensu*; and the *Metaphysica*, I.-V., together with an abridgement of what he wrote on the remaining books of the *Metaphysica*. His commentaries were greatly esteemed among the Arabians, who translated many of them. There are also several original writings by Alexander still extant.

ALEXANDER OF HALES (ALEXANDER HALENSIS), surnamed *Doctor Irrefragabilis* and *Fons Vite*, a celebrated English theologian of the 13th century. Born in Gloucestershire, and trained in the monastery of Hales, from which he takes his name, he was early raised to an archdeaconry. In 1222, when at the height of his fame, Alexander entered the order of Minorite Friars and thenceforward lived in strict seclusion. He died in 1245, and was buried in the convent of the Cordeliers at Paris, where he spent the last twenty-three years of his life.

ALEXANDER OF TRALLES (ALEXANDER TRALIANUS), a medical writer, was a native of Tralles, a city of Lydia, and lived probably about the middle of the 6th century. He is the author of a work, divided into twelve books, in which he treats of bodily distempers. He was the first to open the jugular vein, and to use cantharides as a blister for the gout.

ALEXANDER BAEAS (a surname that probably means "lord"), a man of low birth who professed to be the son of Antiochus Epiphanes, and eventually became king of Syria. The new king soon made himself hateful to his subjects by his voluptuousness and debauchery, and this encouraged Demetrius Nicator, the eldest son of Demetrius Soter, to claim his father's crown. Alexander took the field against him, but was defeated in a pitched battle, and fled to Abæ in Arabia, where he was murdered by the emir, with whom he had sought refuge, 145 B.C.

ALEXANDER JANNÆUS, king of the Jews, succeeded his brother Aristobulus in 104 B.C., and died in 79 B.C.

ALEXANDER SEVERUS, Roman Emperor. See SEVERUS.

ALEXANDER was the name of eight POPES:—

ALEXANDER I., bishop of Rome, succeeded Evaristus in 108 or 109 A.D., and, according to Eusebius, suffered martyrdom under Hadrian in the year 119.

ALEXANDER II., whose family name was *Anselmo Baggio*, was born at Milan, and occupied the papal chair from 1061 to 1073.

ALEXANDER III. (*Rolando Ranuci* of Siena), cardinal and chancellor of the Roman church, was elected to the papedom in 1159, and reigned until 1181. His career is of great historical importance on account of the vigor and ultimate success with which he carried out the ideas and policy of Hildebrand in opposition to Frederick Barbarossa and Henry II. of England. Three anti-popes (Victor IV., 1159; Pascal III., 1164; Calixtus III., 1168) were confirmed by the German emperor in succession.

ALEXANDER IV., *Count Rinaldo de Segni*, cardinal-bishop of Ostia, occupied the papal chair from December 1254 till his death in May 1261. He seems to have been of a weak character, and in the struggle against the house of Hohenstaufen, which he inherited from his predecessors, he did little to strengthen the position of the papacy. The last years of his pontificate were passed at Viterbo, where he was compelled to take

refuge on account of the violent struggles at Rome between the factions of the Guelphs and the Ghibellines.

ALEXANDER V. (*Pietro Philargi*), a native of Candia, enjoyed the dignity of Pope for only ten months, from the 26th June 1409 to the 3d May 1410. He died, as was generally believed, of poison administered by Balthasar Cossa, who became his successor under the title of John XXIII.

ALEXANDER VI. (*Rodrigo Borgia*), memorable as the most characteristic incarnation of the secular spirit of the papacy of the 15th century, was born at Xativa in Valencia, 1st January 1431. His biographers all but unanimously assert his patronymic to have been Lenzuoli (in its original Valencian form, Llançol), and the name of Borgia (or more properly Borja) to have been assumed on his adoption by his maternal uncle. Francisco Escolano, however, a compatriot, positively affirms (*Cronica*, lib. vi. cap. 33), that Llançol was his mother's name, and that his father was Gíofré Borja. It is also disputed whether he originally followed the legal or the military profession; the former appears more probable. In either case, his career was determined by his uncle's elevation to the papacy as Calixtus III., 8th April 1455, and his own immediate summons to Rome, where he was reserved *in petto* as cardinal in the ensuing February, publicly promoted in September, and by an unparalleled act of nepotism elevated to the lucrative and dignified office of vice-chancellor in the following July. He also succeeded his uncle as archbishop of Valencia. An elder brother, Pedro Luis, was made generalissimo of the papal forces by land and sea. The animosity created by so invidious an exaltation prepared Rodrigo's subsequent feud with the Roman patriciate. For the moment he was all-powerful, and the letters of that dextrous courtier Æneas Sylvius attest the importance attached to his good word.

On the death of the jovial Paul (1471), Borgia is mentioned, along with Cardinals Orsino and Gonzaga, as one of the three who chiefly contributed to place the tiara on the brows of the then famous preacher and exemplary ascetic Sixtus IV., who immediately (*per fuggire l'ingratitude*) bestowed on him the opulent abbey of Subiaco, and raised him to the dignity of cardinal-bishop. Innocent VIII., the successor of Sixtus, owed his election to Borgia's coalition with the late pope's nephew, and the fortunes of the former remained unimpaired throughout his tranquil pontificate. The long malady which terminated it afforded scope for the intrigues of aspirants to the succession; and when the cardinals entered into conclave (August 1492), already the rumor ran that a Spaniard would be pope. The simoniacal character of the election is indisputable. We need not believe that the opulent and high-spirited Cardinal Ascanio Sforza was tempted with four mule-loads of silver, but his instant elevation to the vice-chancellorship speaks for itself. Cardinal Orsino was bought with Borgia's palace in Rome; Cardinal Colonna with the abbey of Subiaco; money gained the minor members of the Sacred College; five cardinals alone are recorded as incorruptible. Borgia's uneasiness was betrayed by his hasty assumption of the pontifical vestments, and premature announcement of the election to the expectant crowd. He assumed the name of Alexander VI. The allocation to the cardinals breathed spirit and dignity: an admonitory discourse to his son Cæsar, which may be read in Gordon, is an invention of the anonymous romancer. The pomp of his coronation far surpassed preceding examples, and the compliments of foreign ambassadors on the majesty of his mien and the maturity of his wisdom were echoed by a public accustomed to simony, relieved at their deliverance from a period of anarchy, and sensible of their need

or a firmer hand. This hope Alexander justified and surpassed. Ere long he had divided Rome into judicial districts, placed a magistrate at the head of each, and himself established a weekly audience, at which, by the admission of the malcontent Infessura, "he administered justice after a marvellous sort."

Alexander's pontificate might have been less eventful but for a circumstance beyond his control. The political system of Italy was on the eve of dissolution. Ludovico the Moor, anxious to confirm himself in his ill-gotten duchy of Milan, was already tempting the French monarch across the Alps by the bait of the kingdom of Naples. As of old in Greece, so now dissensions and political corruption were about to cast down the civilization of Italy at the feet of the stranger. The passion for family aggrandisement on this occasion impelled Alexander to a patriotic course. His third son Giofr  had espoused the illegitimate daughter of the king of Naples, and received as dower the principality of Squillace. When, therefore, the French envoys demanded the investiture of Naples, they met with a flat refusal. This encouraged Alexander's enemies. Cardinal della Rovere (Julius II.) withdrew from the papal court, seized upon Ostia, and from thence addressed urgent appeals to the French king to march upon Rome, convene a council, and purge Christendom of the simoniacal pope. On this side Alexander felt himself indeed vulnerable. Casting about for alliances, he dispatched an envoy to the Sultan; the ambassador was arrested as he returned with a favorable reply; and the publication of his instructions created a fresh scandal. Others still, had Roman manners been less lax, might have arisen from the marriage of the pope's acknowledged daughter Lucretia to the Lord of Pesaro, under the auspices of the whole Sacred College, and from the elevation of his second son C sar to the cardinalate at the age of eighteen, unblushing perjury being employed to conceal his illegitimate birth. Yet, at the same period, the successor of Peter appeared for the last time in history as the undisputed bestower of kingdoms and the ultimate tribunal of appeal for Christian nations. Spain and Portugal resorted to him for the adjustment of their claims to the New World; and by tracing a line upon a map he disposed of three-fourths of the human race. Never, according to medi val ideas, had a pope exerted his prerogative with equal grandeur; but the medi val conception of the papacy was passing away, and no one's faith in it was feebler than the pope's.

The French passed the Alps in the autumn of 1494; city after city fell before them, and by the end of the year Rome was added to the number. Alexander had retired into the castle of St. Angelo. His deposition was universally expected, most of all by himself. But Charles' minister, Br nnet, had been gained by the promise of a cardinal's hat. On 16th January the reconciliation of king and pontiff was officially celebrated: they rode together through the city; but distrust still prevailed between them. With really surprising firmness Alexander continued to refuse the investiture of Naples, with which Charles may have thought himself able to dispense. Nothing, indeed, could have been more rapid than his conquest, except his loss of that kingdom. By March the triumph of the French seemed complete: on 6th July their retreating army cut its way through the Italian hosts at Taro in Upper Italy; on 7th July the King of Naples re-entered his capital. Nothing remained of the French incursion except a fatal contagion, and the more fatal revelation of the weakness of Italy.

The retreat of the French left Alexander at liberty to pursue what must have been the main object of any pope of intelligence and spirit in this place—the extirpation of

the petty feudal vassals of the church, and the establishment of the temporal independence of the papacy. This was in truth but a phase of the great struggle of the crown and the people against the aristocracy, universally a characteristic of that age; but the pope's principal motive was unquestionably the insatiable appetite of family aggrandisement. The incurable vice, however, of his policy was imposed upon him by the lack of men and money to carry it into effect. To obtain the former, he was compelled to incline alternately to France and Spain, degrading the majesty of the Holy See, and forfeiting his liberty of action as a member of the Italian body politic. The finances had to be recruited by the sale of offices and spiritual privileges of every kind. Such practices had long been prevalent at Rome, but never had they attained the enormity, the effrontery, or the method imparted to them by Alexander.

His enterprise was at first unfortunate. After some petty successes the papal forces were routed by the Orsini, January 1497. Spanish aid was invoked; the Great Captain checked the Orsini and recovered Ostia. Alexander's spirits rose; on 7th June he alienated Benevento in favor of his eldest son, the Duke of Gandia. That day week the duke disappeared; his body, pierced with wounds, was soon found in the Tiber. The public voice attributed the murder to the pope's second son, the Cardinal C sar Borgia, but on no other grounds than his capability of any atrocity, and the gain that accrued to him by this.

C sar Borgia, meanwhile, was bent on improving the opportunity which he had found or made. Three months after Savonarola's death he propounded to the assembled cardinals his desire to renounce ecclesiastical orders for his soul's health, and was soon at liberty to contract a royal alliance. After encountering a refusal from the daughter of the King of Naples he repaired to France, and there (May 1499) espoused a princess of the house of Navarre, receiving the title of Duke of Valentinois from the French king. Lucretia also benefited by her family's enlarged views; her alliance with the lord of Pesaro was dissolved on a pretext of nullity, and she married the Duke of Bisceglia, a natural son of the King of Naples. This had occurred a year previously, when Alexander still attached weight to the Neapolitan alliance; but the political horizon was now changed. In October 1499 a French army crossed the Alps and conquered Lombardy, almost without resistance. The watchword was thus given for the papal campaign in the Romagna. Caterina Sforza, regent of Imola and Forl , received a summons to discharge certain arrears long owing to her suzerain. C sar Borgia followed with an army on the heels of the messenger, and although the intrepid princess defended herself stoutly by sword and poison, she was compelled to succumb to the "Gonfalonier of the Church." France and Spain, meanwhile, had concerted their secret arrangement for the dispossession of the King of Naples, and C sar Borgia prepared to remove the only obstacle to his own participation in it. In July 1500 the Duke of Bisceglia, Lucretia's Neapolitan husband, was attacked by assassins in broad day, and left desperately wounded. The pope placed guards over the prince; Lucretia and her sister-in-law prepared his food to avoid poison; but none the less "quum ex vulneribus sibi datis mori nolisset"—Alphonso of Bisceglia was strangled by men in masks. "All Rome," writes the Venetian ambassador, "trembles before the duke." The worst times of the empire seemed returned, even to the amusements of the amphitheatre, where C sar, whose tastes were those of a Spaniard, despatched six bulls successively, severing the head of one from the shoulders at a stroke. The pope looked on helplessly at the Frankenstein of his own crea-

tion; "he loves and hugely fears his son," reports the Venetian, who adds that Cæsar had pursued his father's favorite secretary to his arms, and there butchered him, the pope's robe being saturated with the gushing blood. Alexander's easy temper stood him in good stead.

"These devils cannot be cast out by holy water," Cardinal Juan Borgia had formerly reported of the turbulent occupants of the Romagna. The experiment of casting out Satan Beelzebub remained to be tried. In April 1501 Cæsar entered upon his second campaign, and by perfidy or force quickly added Pesaro, Rimini, and Faenza to his former possessions. Attentive to the maxims of sagacious tyranny, he governed with substantial justice. If his coffers had to be filled by oppression, the odium would be cast on some subordinate agent, whose body, his mission fulfilled, would be found dismembered in the market-place. France and Spain, meanwhile, proceeded to the spoliation of the defenceless king of Naples, and Cæsar (July 1501) shared in the conquest and the booty. In September Alexander himself undertook a campaign against the Colonnas, and humbled those haughty patricians by the capture of all their castles. Lucretia, to the general scandal, represented him in his absence. Worse scandals were in store, could we implicitly credit the contemporary diarist's account of the scenes enacted in the apostolic palace after Alexander's return, but the passage is probably interpolated. At this period the papal court was engrossed with preparation for Lucretia's marriage to Alphonso, son of the Duke of Ferrara, which was celebrated by proxy in December. The pope's daughter, cardinals and prelates in her train, undertook a stately progress through Italy to Ferrara, where she was received with extraordinary splendor. Piombino was reduced at this time, and in July Cæsar treacherously rendered himself master of Urbino. Immediately afterwards his power received a severe shock from the defection of his principal *condottieri*. Cæsar temporised until, to the admiration of Machiavelli, then Florentine envoy at his camp, his adversaries were decoyed into his hands, seized, and executed (31st December 1502). The news gave the signal at Rome for the arrest of the Orsini and the occupation of their castles; thus was the humiliation of the Roman aristocracy completed. Cardinal Orsino was committed to Saint Angelo, where the services of the Papal master of the ceremonies were soon required for his interment. "But I," remarks Burcardus, with quaint naïveté, "turned the business over to my assistant, for I did not want to know more than was good for me." It must be owned that in that age it would have been impossible to bring a cardinal publicly to the block. This apology does not apply to the charges of secret poisoning which have mainly given the Borgias their sinister celebrity, and which became fearfully rife in Alexander's later years. They are unproved as yet, but are certainly countenanced by the opulence of the supposed victims, and the avidity with which the pope pounced upon their effects, especially in the case of his rapacious datary, Cardinal Ferrari.

By May 1503 Spain had dispossessed France of her share of ill-gotten Naples. A general war seemed imminent; Alexander and Cæsar leaned to the side of Spain. The Sacred College was already full of Spanish cardinals, docile instruments of their countryman, and Alexander might well deem that he had fettered the Church to the fortune of his house. Men looked for the proclamation of Cæsar as king of Romagna, and the division of the temporal and spiritual power. The ancient mutual relations of pope and emperor would have been revived, but on the narrow area of Central Italy. But this was not to be. On the morning of 12th August "Pope Alexander felt ill;" so did Cæsar Borgia. Every

one knows the story of the supper given to the ten cardinals in the villa, and the fatal exchange of the poisoned flask. This picturesque tale is almost certainly a fiction. An attempt to destroy ten cardinals at once is inconceivable; it would be easier to believe Cardinal Castellesi's assertion that he was to have been the victim, as his sickness at the time is confirmed from an independent source. But his character does not stand high, and the symptoms of his disorder, as described by himself, differ totally from Alexander's, which were those of an ordinary Roman fever. The progress of the pope's malady may be minutely traced in the diary of Burcardus and the despatches of the Ferrarese envoy. He expired on the evening of 18th August, duly provided with all the needful sacraments of the Church.

ALEXANDER VII. (*Fabio Chigi*), was born at Siena on the 13th February 1599, and occupied the papal chair from the 7th April 1655 to the 22d May 1667. Before his elevation he had filled successively the offices of inquisitor at Malta, vice-legat at Ferrara, and nuncio to Germany at the conference of Munster. The most noteworthy events of his pontificate were the reception of the ex-queen Christina of Sweden into the Catholic Church, the promulgation of a bull against the Jansenists, and a protracted dispute with Louis XIV. of France, during which the papal see lost possession of Avignon (1662). Alexander canonised Francis of Sales in 1665.

ALEXANDER VIII. (*Pietro Ottoboni*), born at Venice in 1610, was raised to the pontificate in October 1689 in succession to Innocent XI. He assisted his native state in its wars with the Turks. He died in Feb. 1691.

ALEXANDER I., King of Scotland, son of Malcolm Canmore, succeeded his brother Edgar in 1107, and died in 1124. He was better educated than any of his predecessors, owing to the care of his mother, the amiable Margaret of England. He died at Sterling, and, being childless, was succeeded by his brother David I.

ALEXANDER II., King of Scotland, was born at Haddington in 1108 (died 1249), and succeeded his father, William the Lion, in 1214. Though still young, he exhibited the same prudence and firmness which marked his whole conduct in life. He was excommunicated in 1216 for associating with the English barons in their opposition to King John; but his prudence enabled him to recover the good opinion of the pope, and placed him on the best footing with the English king, Henry III., John's successor. While engaged in quelling an insurrection in Argyleshire, he died of fever in the island of Kerrera in 1249.

ALEXANDER III., King of Scotland, son of Alexander II. by his second wife, Mary de Coucy, was born at Roxburgh on the 4th September 1241 (died 1286), and succeeded to the throne on the death of his father in 1249. The fact that in this case the succession of a minor was unopposed is noteworthy, as showing that the hereditary principle had now established itself. By a provision of the treaty of Newcastle Alexander had been betrothed in infancy to the daughter of the king of England, and it suited Henry's policy to insist on an early fulfilment of the contract. Notwithstanding the extreme youth of the parties, the marriage was celebrated in York on the 25th December 1251. On this occasion Alexander is said by Matthew Paris to have done homage for his estates in England, and to have refused homage for his kingdom of Scotland, on the ground that he had not consulted on the matter with his proper advisers. The internal condition of the country seems to have improved greatly during the latter years of Alexander's reign. A wise and vigorous administration ensured peace and consequent prosperity. The prospect of Scotland was perhaps never brighter in all her early history than towards

the close of his reign, but it was suddenly overcast. On the 12th March 1286 the king was killed by a fall from his horse while riding on the coast of Fife opposite Edinburgh. A spot near Kinghorn, known as the King's Wud End, is pointed out as the scene of the tragical event.

ALEXANDER, PAULOVICH, Emperor of Russia—born on 28th December 1777, died 1825—was the son of Paul, afterwards emperor, by Maria, daughter of Prince Eugene of Würtemberg. His early education was conducted under his excellent mother, and afterwards was carefully directed by his grandmother, the Empress Catherine II., who confided its general superintendence of Frederick Cæsar de La Harpe. On the assassination of his father Paul in 1801, Alexander succeeded to the Russian throne. He had been married in 1793 to the Princess Louisa Maria of Baden but the union proved an unhappy one, and had no issue.

The policy of the young emperor was indicated by his concluding a peace with Britain, against which his father had declared war. In 1805 he joined Austria and Sweden in a coalition with Great Britain against the pretensions of France.

For nearly five years Alexander appeared attached to the alliance of France; but the privations of his subjects by the interruption of the commerce with England, and the intolerable load of Napoleon's "Continental System," at length induced him to return to his old alliance, and to declare war against France on March 19, 1812. On the 24th April he left St. Petersburg to join his armies on the western frontier of Lithuania. Napoleon assembled the most numerous and magnificent army that had ever been brought together in modern times, augmented by the unwilling levies of Prussia and Austria, and entered Russia on the 25th of June 1812. The first encounter was at Borodino, where there was a well-contested action, in which each army suffered the loss of 25,000 men. The burning of Moscow, and the subsequent retreat of Napoleon, during which his army was all but annihilated, are among the best known events of modern history.

After the deposition of Napoleon the allied sovereigns visited England. By the treaty of Vienna, Alexander was acknowledged king of Poland; but before the congress of Vienna broke up, Napoleon had escaped from Elba, and was enthusiastically received at Paris. The two eastern emperors and the king of Prussia remained together until the battle of Waterloo gave peace to Europe. On the advance of the British and Prussians to Paris, the three allied sovereigns again made their entry into that capital, where they concluded, on September 26, the treaty which has been designated the *Holy Alliance*.

Alexander was henceforward chiefly occupied in the internal administration of his vast dominions, which certainly improved more during the twenty-five years of his reign than under any of his predecessors from the time of Peter I. The gradual abolition of the feudal servitude of the peasantry, begun by the most enlightened of his predecessors, was continued under Alexander. Education, agriculture, manufactures, commerce, were also greatly extended; while literature and the fine arts were liberally encouraged. His disposition has been represented by his subjects as mild and merciful; yet his influence in the affairs of Europe was not exerted in the cause of public liberty.

Early in the winter of 1825 he left St. Petersburg for the last time on a tour of inspection of his southern provinces. About the middle of November he was attacked by a violent intermittent fever, which proved fatal at Taganrog on December 1, 1825.

ALEXANDER JAROSLAWITZ NEVSKI,

SAINT, Grand Duke of Vladimir, second son of the Grand Duke Jaroslaw II., was born at Vladimir in 1219, and died 14th November 1263. He became prince of Novgorod on the resignation of his father in 1239, his elder brother having died. While Batu Khan was sweeping with his Tartars over the south, the Swedes, Danes, and Livonian knights took advantage of this to oppress the north of Russia; Alexander accordingly directed his arms against them, and gained a brilliant victory with his small army on the 15th July 1240. At his death the people universally spoke of him as their father and protector, and afterwards recorded his deeds in their songs, and honored him as a saint. Peter the Great, when founding St. Petersburg, erected a magnificent monastery to the east of the city in honor of the victory won there by his great predecessor, and created in 1722 one of the eight Russian orders, that of Alexander Nevski.

ALEXANDER, ARCHIBALD, D.D., a Presbyterian divine of America, was born of a family, originally Scotch, in Rockbridge county, Virginia, on the 17th April 1772, (died 1851.) Dr. Alexander wrote a considerable number of works on theology, which have had a large circulation. Among these may be mentioned his *Outlines of the Evidences of Christianity* (1823), which has passed through several editions, and been translated into various languages; and his *Treatise on the Canon of the Old and New Testament* (1826). He was also a frequent contributor to the *Biblical Repertory*, edited by Professor Hodge.

ALEXANDER, JOSEPH ADDISON, D.D., third son of the preceding, one of the most eminent biblical scholars of America, was born in Philadelphia in 1809 (died 1860). Dr. Alexander wrote several valuable works in his own department, the most important being a *Translation of and Commentary on the Psalms*, a *Critical Commentary on the Prophecies of Isaiah*, and a treatise on primitive church government. He also contributed numerous articles to the *Biblical Repertory* and the *Princeton Review*. At the time of his death he was engaged along with Dr. Hodge in the preparation of a commentary on the New Testament.

ALEXANDER, SIR WILLIAM, earl of Stirling, poet. From his (rare) engraved portrait, William was, it appears, aged 57 in 1637; so that he must have been born (at Menstrie House, where afterward was born Sir Ralph Abercromby) in 1580. The grammar school of neighboring Stirling probably furnished his early education; of his later, it is simply known that he attended the university of Glasgow. On leaving it he proceeded on his travels with Archibald, seventh earl of Argyle. It is supposed that it was during his sojourn on the Continent he composed his series of sonnets, afterwards published under the title of *Aurora* (1604). He was tutor to the young earl. Upon his return he proceeded to court, and won for himself speedily a name as a gentleman of parts and learning. In 1626 he was appointed Secretary of State for Scotland, and in 1630 created a peer, as Lord Alexander of Tullibody, and Viscount Stirling. In 1631 he was made an extraordinary judge in the Court of Session. In 1633 he was advanced a step in the peerage, being created Earl of Stirling and Viscount Canada; and in 1639 Earl of Dovan. In 1637 he collected his poetical works, and issued them as *Recreations with the Muses*, "by William, Earle of Sterline," with his portrait engraved by Marshall. This folio did not include either *Aurora* or the *Psalms of King David* (Oxford, 1631), although there seems little doubt that he, rather than King James, was the main author of the latter. It, however, first gave his second sacred poem (incomplete) of *Jonathan*. He died in London on 12th February, 1640. Lauded by Sir

Robert Ayton and William Drummond of Hawthornden, the Earl of Sterling, nevertheless, soon fell out of men's memories. The recent careful and beautiful edition of his *Poetical Works* (3 vols.) ought to revive his fame; for while there is too often a wearying wordiness, the student-reader is rewarded with "full many a gem of purest ray serene." His *Doomesday* has some grand things; his *Aurora* suggests comparison with Sidney's *Astrophel and Stella*. (Works as above; Laing's *Baillie's Letters and Journals*, iii. 529; *Drummond MSS.*, by Laing.)

ALEXANDRETТА. See SCANDEROON.

ALEXANDRIA, a city of Lower Egypt, and for a long time its capital, was situated on the Mediterranean, 12 miles west of the Canopic mouth of the Nile, 31° 11' N. lat., and 29° 52' E. long. The ancient city was oblong in form, with a length from east to west of 3 to 4 a breadth from north to south of 1, and, according to Pliny, a circumference of 15 miles. Lake Mareotis bathed its walls on the south, and the Mediterranean on the north; on the west was the Necropolis, and on the east the Hippodrome. The city was laid out in straight parallel streets, one of which, about 200 feet wide, ran westward from the Canopic gate to the Necropolis. This street was decorated with magnificent houses, temples, and public buildings, and was intersected by another of the same breadth and magnificence, running from south to north. Ancient Alexandria was divided into three regions: (1.) The *Regio Judaeorum*, or the Jews' quarter, forming the north-east portion of the city. (2.) *Rhacotis* on the west, occupied chiefly by Egyptians. Its principal building was the Serapeum, or temple of Serapis, containing an image of the god, brought probably from Pontus. A large part of the famous library of Alexandria was placed in the Serapeum. (3.) *Brucheum*, the Royal or Greek quarter, forming the remaining and most magnificent portion of the city. An artificial mole, called the *Heptastadium*, nearly a mile in length, stretched from the continent to the isle of Pharos. Between this mole and the peninsula of Lochias was the greater harbor; on the other side of the mole was the harbor called *Eunostos*, or Safe Return. The two were connected with each other by two breaks in the mole, crossed by two bridges, which could be raised at pleasure. Within the harbor *Eunostos* was an artificial basin called *Kibotos*, i.e., the Chest, communicating with lake Mareotis by a canal, from which a separate arm stretched eastward to the Canopic mouth of the Nile. On the eastern point of the island of Pharos was the famous lighthouse, said to have been 400 feet high. It was begun by Ptolemy Soter, and finished by his successor, Philadelphus. It cost 800 talents, which, if Alexandrian, is equivalent to £248,000. In the time of Diodorus Siculus (50 B.C.) the population of Alexandria was estimated at 300,000 free-men, with probably at least as many slaves.

The city was founded by Alexander the Great 332 B.C.; but the island of Pharos was from an early period a refuge of Greek and Phœnician sea-rovers, a fact commemorated in the name "Pirates' Bay," given to a deep indentation on the north side of the island; and on the mainland was the little town of Rhacotis, subsequently incorporated in the quarter of that name. The architect employed by Alexander was the celebrated Dinocrates, who had acquired a high reputation by rebuilding the temple of Diana at Ephesus.

Alexandria seems from this time to have regained her old prosperity, becoming an important granary of Rome, which, doubtless, was one of the chief reasons that induced Augustus to place it directly under the imperial power. In 215 A.D. the emperor Caracalla visited the city; and, in order to repay some insulting satires that

the inhabitants had made upon him, he commanded his troops to put to death all youths capable of bearing arms. This brutal order seems to have been carried out even beyond the letter, for a general massacre was the result. Notwithstanding this terrible disaster, Alexandria soon recovered its former splendor, and for a time was esteemed the first city in the world after Rome. As the power of the Cæsars decreased, however, their hold over Alexandria was weakened, and the city itself suffered from internal commotions and insurrections, which gradually destroyed its importance. In 616 it was taken by Chosroes, king of Persia; and in 640 by the Arabians, under Amru, after a siege that lasted fourteen months, during which Heraclius, the emperor of Constantinople, did not send a single ship to its assistance. Notwithstanding the losses that the city had sustained, Amru was able to write to his master, the caliph Omar, that he had taken a city containing "4000 palaces, 4000 baths, 12,000 dealers in fresh oil, 12,000 gardeners, 40,000 Jews who pay tribute, 400 theatres or places of amusement." The following story, relating to the destruction of the library, is told by Abulfaragius:—John the Grammarian, a famous peripatetic philosopher, being in Alexandria at the time of its capture, and in high favor with Amru, begged that he would give him the royal library. Amru told him that it was not in his power to grant such a request, but promised to write to the caliph for his consent. Omar, on hearing the request of his general, is said to have replied that if those books contained the same doctrine with the Koran, they could be of no use, since the Koran contained all necessary truths; but if they contained anything contrary to that book, they ought to be destroyed; and therefore, whatever their contents were, he ordered them to be burnt. Pursuant to this order, they were distributed among the public baths, of which there was a large number in the city, where for six months, they served to supply the fires.

ALEXANDRIA, the modern city, stands partly on what was the island of Pharos, now a peninsula, but mostly on the isthmus by which it is connected with the mainland. This was originally an artificial dyke connecting the island with the land opposite; but, through the constant accumulation of soil and ruins, it has attained its present dimensions. The principal public and government buildings are on the peninsula. The ancient city was situated on the mainland, adjacent to the modern town, and the extent of the ruins that still exist sufficiently attests its greatness. The general appearance of Alexandria is by no means striking; and from its situation its environs are sandy, flat, and sterile. It was formerly surrounded by strong turreted walls, with extensive outworks, but in various parts the walls have lately been destroyed to make way for improvements.

In the Turkish quarter the streets are narrow, irregular, and filthy, and the houses mean and ill-built. The Frank quarter, on the other hand, presents the appearance of a European town, having handsome streets and squares, and excellent shops. The streets have been much improved lately by being nearly all paved.

Few of the remains of the ancient city are now visible. Most of those that were to be seen a few years ago have since disappeared, but frequently in making excavations portions of ancient masonry, broken columns, and fragments of statues are discovered. Among the best known of the ancient relics are the two obelisks commonly called "Cleopatra's Needles." They were originally brought from Heliopolis to Alexandria in the reign of Tiberius, and were set up in front of the temple of Cæsar. They are of red granite, and covered with hieroglyphics. One was given to the English government, and now stands on the Thames embank-

ment, and the other, the larger, was given to the United States, and now stands in Central Park, New York, having been brought over by Lieut. Goringe in tow of a vessel donated for the purpose by the Khedive. Near the obelisks were the ruins of an old round tower, commonly called the "Roman Tower." But the most striking of the ancient monuments is the column styled "Pompey's Pillar."

Alexandria has been mainly indebted for its prosperity to the advantages of its position for trade. It was this that first attracted the attention of its far-seeing founder to the site, and its subsequent history in no way belied his penetration.

Alexandria has two ports, an eastern and a western. The latter, called also the Old Port, is by far the larger and better of the two. It extends from the town westward to Marabout, nearly 6 miles, and is about a mile and a-half in width. It has three principal entrances. The first, or that nearest the city, has about 17 feet of water, but is narrow and difficult of access, and only used by small vessels and boats. The second or middle, which is also the principal entrance, is about a quarter of a mile wide, and has, where shallowest, 27 feet of water. The eastern side of this entrance is marked by buoys, and there are landmarks for guiding to the channel. The third or western entrance has its western boundary about three-eighths of a mile from Marabout Island, is about half a mile wide, and has from 25 to 27 feet of water where shallowest. Within the harbor ships may anchor close to the town in from 22 to 40 feet of water.

The harbor was formerly strongly fortified, but a few years ago the forts were almost entirely destroyed by an English bombardment.

The population of Alexandria is of a very mixed character, consisting, besides the native Turks and Arabs, of Armenians, Greeks, Syrians, Italians, French, English, Germans, &c. At one time the ancient city is believed to have contained 600,000 inhabitants. At present its population is about 320,000.

ALEXANDRIA, a town of Scotland, in the parish of Bonhill, Dumbartonshire, pleasantly situated on the west bank of the river Leven, about three miles from Dumbarton, with which it is connected by a branch railway. Population, 6,713.

ALEXANDRIA, a city of Virginia, port of entry, and capital of Alexandria county, is situated on the Potomac river, seven miles south of Washington city. It possesses an excellent harbor, and its railway connections include the Baltimore and Potomac, Virginia Midland, and Richmond and Danville roads, by which the city is brought into close communication with all parts of the country. The city contains three banks, two daily and three weekly papers, a court house and county buildings, seventeen churches, graded schools, two Catholic academies, a public library, hotels, stores, etc., and many handsome private residences. Considerable commerce, both foreign and domestic, centers here. Alexandria was the scene of the killing of Col. Elmer Ellsworth by a hotel-keeper named Jackson, in May, 1861. Population (1900), 14,528.

ALEXANDRIAN MS. (*Codex Alexandrinus*), the name given to a Greek manuscript of the Old and New Testaments now in the British Museum. The MS. was presented in 1628 to King Charles I., through his ambassador at the Porte, by Cyrillus Lucaris, patriarch of Constantinople. There seems no good reason to doubt that Cyrillus had brought the document from Alexandria, where he had held the office of patriarch, although Wetstein is of opinion, upon what seems inadequate evidence, that he procured it from the monastery of Mount Athos, where he had resided prior to his coming to Alexandria.

It was transferred in 1753 from the king's private library to that of our national museum, where the volume containing the text of the New Testament is now, or was lately, open to public inspection under a glass case. The entire MS. consists of four small folio volumes, three of which contain the text of the Old and one that of the New Testament. The portion, however, containing the Old Testament is more complete than that which contains the New, the *lacune* in the former occurring chiefly in the book of Psalms; while in the New Testament the following portions are wanting—viz., the whole of Matthew's Gospel up to chap. xxv. 6, from John vi. 50 to viii. 52, and from 2 Cor. iv. 13 to xii. 6. Occasionally, also, single letters, as well as the titles of certain divisions, have been destroyed by the operations of the bookbinder. The material of which the MS. is composed is very thin vellum, the page being about 13 inches high by 10 broad, containing from 50 to 52 lines in each page, each line consisting of about 20 letters. The number of pages is 773, of which 640 are occupied with the text of the Old Testament, and 133 with that of the New. The characters are *uncial*, but larger than in the Vatican MS. As regards the date of the MS. very opposite opinions have been held. One critic placed it as low down as the 10th century, but this supposition has been justly characterised by Tregelles as so opposed to all that is known of palæography as not to deserve a serious refutation. From the circumstances that the MS. does not exhibit any traces of *stichometry*—a mode of arranging the text in lines consisting of a larger or smaller number of words, at the end of which the reader was to pause, which was applied to the Pauline epistles by Euthalius of Alexandria in the year 458, and which soon came into general use—it has been inferred that the MS. is not of later date than the middle of the 5th century. Again, the presence, in the text of the Gospels of the Ammonian sections and Eusebian canons, and of the epistle of Athanasius (who died in 373) to Marcellinus, which is prefixed to the Psalms, shows that it could not be older than the end of the 4th century. In addition to this external testimony, palæographic reasons, such as the general style of the writing, and the formation of certain letters, would seem to refer the MS. to about the middle of the 5th century, and this date is now generally acquiesced in by scholars. There is an Arabic inscription, indeed, written on the page which contains the list of the various books of the Old and New Testament, which states that the MS. was written by the hand of the martyr Thecla, while a Latin inscription by Cyril himself gives the tradition that the Thecla who wrote the MS. was a noble Egyptian lady who lived shortly after the Council of Nice.

ALEXANDRIAN SCHOOL. Under this title are generally included certain strongly-marked tendencies in literature and science which took their rise in the city of Alexandria. That city, founded by Alexander the Great about the time when Greece, in losing her national independence, lost also her intellectual supremacy, was in every way admirably adapted for becoming the new centre of the world's activity and thought. Its situation brought it into commercial relations with all the nations lying around the Mediterranean, and at the same time rendered it the one communicating link with the wealth and civilisation of the East. The great natural advantages it thus enjoyed were artificially increased to an enormous extent by the care of the sovereigns of Egypt. Ptolemy Soter (reigned 306–285 B.C.), to whom, in the general distribution of Alexander's conquests, this kingdom had fallen, began to draw around him from various parts of Greece a circle of men eminent in literature and philosophy. To these he gave every facility for the prosecution of their learned researches. Under the in-

spiration of his friend Demetrius Phalereus, the Athenian orator, this Ptolemy laid the foundations of the great library, and originated the keen search for all written works, which resulted in the formation of a collection such as the world has seldom seen. He also built, for the convenience of his men of letters, the Museum, in which, maintained by the royal bounty, they resided, studied, and taught. This Museum or academy of science was in many respects not unlike a modern university. The work thus begun by Ptolemy Soter was carried on vigorously by his descendants, in particular by his two immediate successors, Ptolemy Philadelphus and Ptolemy Euergetes. Philadelphus (285-247 B.C.), whose librarian was the celebrated Callimachus, bought up all Aristotle's collection of books, and also introduced a number of Jewish and Egyptian works. Among these appears to have been a portion of the Septuagint. Euergetes (247-222 B.C.) largely increased the library by seizing on the original editions of the dramatists laid up in the Athenian archives, and by compelling all travellers who arrived in Alexandria to leave a copy of any work they possessed.

The intellectual movement so originated extended over a long period of years. If we date its rise from the 4th century B.C., at the time of the fall of Greece and the foundation of the Græco-Macedonian empire, we must look for its final dissolution in the 7th century of the Christian era, at the time of the fall of Alexandria and the rise of the Mahometan power. But this very long period falls into two divisions. The first, extending from about 306 B.C., to about 30 B.C., includes the time from the foundation of the Ptolemaic dynasty to its final subjugation by the Romans; the second extends from 30 B.C., to 640 A.D. The characteristic features of these divisions are very clearly marked, and their difference affords an explanation of the variety and vagueness of meaning attaching to the term Alexandrian School. In the first of the two periods the intellectual activity was of a purely literary and scientific nature. It was an attempt to continue and develop, under new conditions, the old Hellenic culture. This direction of effort was particularly noticeable under the early Ptolemies, Alexandria being then almost the only home in the world for pure literature. During the last century and a half before the Christian era, the school, as it might be called, began to break up and lose its individuality. This was due partly to the state of government under some of the later Ptolemies, partly to the formation of new literary circles in Rhodes, Syria, &c., whose supporters, though retaining the Alexandrian peculiarities, could scarcely be included in the Alexandrian school. The loss of active life, consequent on this gradual dissolution, was much increased when Alexandria fell under Roman sway. Then the influence of the school was extended over the whole known world, but men of letters began to concentrate at Rome rather than at Alexandria. In that city, however, there were new forces in operation which produced a second grand outburst of intellectual life. The new movement was not in the old direction—had, indeed, nothing in common with it. With its character largely determined by Jewish elements, and even more by contact with the dogmas of Christianity, this second Alexandrian school resulted in the speculative philosophy of the Neo-Platonists and the religious philosophy of the Gnostics and early church fathers.

Alexandrian School of Literature.—The general character of the literature of the school appears as the necessary consequence of the state of affairs brought about by the fall of Greek nationality and independence. The great works of the Greek mind had formerly been the products of a fresh life of nature, and perfect free-

dom of thought. All their hymns, epics and histories were bound up as their individuality as a free people. But the Macedonian conquest at Chæronea brought about a complete dissolution of this Greek life in all its relations, private and political. The full, genial spirit of Greek thought vanished when freedom was lost, with which it was inseparably united. A substitute for this originality was found at Alexandria in learned research, extended and multifarious knowledge. Amply provided with means for acquiring information, and under the watchful care of a great monarch, the Alexandrians readily took this new direction in literature. With all the great objects removed which could excite a true spirit of poetry, they devoted themselves to minute researches in all sciences subordinate to literature proper. They studied criticism, grammar, prosody and metre, antiquities and mythology. The results of this study constantly appear in their productions. Their works are never national, never addressed to a people, but to a circle of learned men. Moreover, the very fact of being under the protection, and, as it were, in the pay of an absolute monarch, was damaging to the character of their literature. There was introduced into it a courtly element, clear traces of which, with all its accompaniments, are found in the extant works of the school.

The forms of poetical composition chiefly cultivated by the Alexandrians, were epic and lyric, or elegiac. Great epics are wanting; but in their place, as might almost have been expected, are found the historical and the didactic or expository epics. The subjects of the historical epics were generally some of the well-known myths, in the exposition of which the writer could exhibit the full extent of his learning, and his perfect command of verse.

The most interesting fact connected with this Alexandrian poetry is the powerful influence it exercised on Roman literature. The literature, especially in the Augustan age, is not to be thoroughly understood without due appreciation of the character of the Alexandrian School.

Alexandrian School of Philosophy.—Although it is not possible to divide literatures with absolute rigidity by centuries, and although the intellectual life of Alexandria, particularly as applied to science, long survived the Roman conquest, yet at that period the school, which for some time had been gradually breaking up, seems finally to have succumbed. The later productions in the field of pure literature bear the stamp of Rome rather than of Alexandria. But in that city, for some time past, there had been various forces secretly working, and these coming in contact with great spiritual changes occurring in the world around, produced a second outburst of intellectual activity.

To the whole of this great movement the title Alexandrian philosophy must be given, although the term is sometimes identified with Neo-Platonism. Of the exact historical origin of it we have no certain notice. Some thinkers are of opinion that even in the Septuagint traces of rationalism can be discovered.

Of Alexandrian literature there are notices in histories of Greek literature, as Müller and Donaldson, or Bernhardt; of Alexandrian philosophy, in general histories of philosophy and of early Christianity.

ALEXANDRINE VERSE, a name given to the leading measure in French poetry. It is the heroic French verse, used in epic narrative, in tragedy, and in the higher comedy. There is some doubt as to the origin of the name; but most probably it is derived from a collection of romances, published early in the 13th century, of which Alexander of Macedon was the hero, and in which he was represented, somewhat like our own Arthur, as the pride and crown of chivalry. Before

the publication of this work most of the trouvère romances appeared in octo-syllabic verse. The new work, which was henceforth to set the fashion to French literature, was written in lines of twelve syllables, but with a freedom of pause which was afterwards greatly curtailed. The new fashion, however, was not adopted all at once. The metre fell into disuse until the reign of Francis I., when it was revived by Jean Antoine de Bœuf, one of the seven poets known as the Pleiades.

ALEXANDROPOL, an important fortress and the largest town in the Erivan district of Russian Armenia. It lies on the direct route from Erivan to Kars and has accommodation for a garrison of 10,000 men. It has a large trade in silk and a population (1900) of 33,000.

ALEXIS, an ancient comic poet, born about 394 B.C. at Thurii in Magna Græcia, the uncle and instructor of Menander. Plutarch says that he lived to the age of 106 years, and according to Suidas he wrote 245 plays, of which the titles of 113 are known.

ALEXIUS I., the nephew of Isaac Comnenus, and the most distinguished member of the Comnenus family, was born in 1048, and died 1118. In early life he signalized himself in the wars against the enemies of his country; but the mean jealousies of the ministers of the emperor Nicephorus (surnamed Botaniates) drove him to take up arms against a sovereign whose cause he had thrice gallantly defended against powerful insurgent leaders; and he ascended the throne of Constantinople in 1081.

ALFANI, DOMENICO, an Italian painter, born at Perugia towards the close of the fifteenth century. The precise date is uncertain, but he was a contemporary of Raphael, with whom he studied in the school of Perugia. The date of his death, according to some, was 1540, while others say he was alive in 1553.

AL-FARABI, ABU NASR MUHAMMAD IBN TARKMAN, one of the earliest Arabian philosophers, flourished during the former half of the 10th century. Philosophy, among the Arabs, was originally an extension of the related sciences of astronomy and medicine, and the first philosophers were physicians. The more eminent of them were court physicians, and to this they doubtless owed their protection against the jealous suspicions of the Mahometan sects. Al-Farabi is supposed (for the detailed accounts of his life are legendary) to have concerned himself more with theory than the practice of medicine; but he is known to have been a physician at the court of Seif-Eddaula, and died when it was at Damascus in 950. Unlike some of his successors, notably Avicenna, he was an ascetic, and his philosophy, which has a slight Platonic infusion, bears traces of the contrast. He was unsympathetic, and the sketches and aphorisms of his which have come down to us (many of his treatises are still in MS.) only partially enable us to reconstruct his philosophy. In his opusculum *De Scientiis* he enumerates six orders of sciences:—(1.) Language, by which he means little more than grammar. (2.) Logic, which he names as an art, conceives generally as a science, and confounds in its details with the corresponding art, with rhetoric and with criticism. (3.) The mathematical sciences, embracing geometry, arithmetic, optics, the science of the stars, music, and the sciences of weights and of capacities (*ingenia*). Arithmetic is abstract and concrete; geometry is active, passive, and speculative; and the science of the stars includes astronomy, astrology, the science of climates, and of dreams and auguries. (4.) The natural sciences, ten in number. (5.) Civil science, including judicial science and rhetoric. (6.) Divine science, or metaphysics. (For information on Al-Farabi, see Munk, *Mélanges*, pp. 341–52; and Steinschneider, *Mémoires de l'Académie de St. Petersburg*, vii. série, tom. xiii. Two of his

opuscula have been translated by Schmölbers, *Documenta Philosophia Arabum*, and two are contained in *Alpharabii Opera Omnia*, Paris, 1638.)

ALFIERI, VITTORIO, chiefly celebrated as the author who raised the Italian tragic drama from its previous state of degradation, was born on the 17th January 1749, in the town of Asti, in Piedmont. He lost his father in early infancy; but he continued to reside with his mother, who married a second time, till his tenth year, when he was placed at the academy of Turin. After he had passed a twelvemonth at the academy, he went on a short visit to a relation who dwelt at Coni; and during his stay there he made his first poetical attempt, in a sonnet chiefly borrowed from lines in Ariosto and Metastasio, the only poets he had at that time read. When thirteen years of age he was induced to commence the study of civil and canonical law; but the attempt only served to disgust him with every species of application, and to increase his relish for the perusal of French romances. By the death of his uncle, who had hitherto taken some charge of his education and conduct, he was left, at the age of fourteen, to enjoy without control his vast paternal inheritance, augmented by the recent accession of his uncle's fortune. He now began to attend the riding-school, where he acquired that rage for horses and equestrian exercise which continued to be one of his strongest passions till the close of his existence.

After some time spent in alternate fits of extravagant dissipation and ill-directed study, he was seized with a desire of travelling; and having obtained permission from the king, he departed in 1766, under the care of an English preceptor. Restless and unquiet, he posted with the utmost rapidity through the towns of Italy; and his improvement was such as to be expected from his mode of travelling and his previous habits. Hoping to find in foreign countries some relief from the tedium and *ennui* with which he was oppressed, and being anxious to become acquainted with the French theatre, he proceeded to Paris. During a journey to London, he engaged in an intrigue with a married lady of high rank; and having been detected, the publicity of an encounter with the injured husband, and of a divorce which followed, rendered it expedient and desirable for him to quit England. He then visited Spain and Portugal, where he became acquainted with the Abbé Caluso, who remained through life the most attached and estimable friend he ever possessed. In 1772 Alfieri returned to Turin, where he again became enamored of a lady, whom he loved with his usual ardor, and who seems to have been as undeserving of a sincere attachment as those he had hitherto adored. In the course of a long attendance on his mistress, during a malady with which she was afflicted, he one day wrote a dialogue or scene of a drama which he left at her house. On a difference taking place between them, the piece was returned to him, and being retouched and extended to five acts, it was performed at Turin in 1775, under the title of *Cleopatra*.

From this moment Alfieri was seized with an insatiable thirst for theatrical fame, and the remainder of his life was devoted to its attainment. His first two tragedies, *Filippo* and *Polinice*, were originally written in French prose; and when he came to versify them in Italian, he found that, from his Lombard origin, and long intercourse with foreigners, he expressed himself with feebleness and inaccuracy. Accordingly with the view of improving his Italian style, he went to Tuscany, and, during an alternate residence at Florence and Siena, he completed his *Filippo* and *Polinice*, and conceived the plan of various other dramas. While thus employed, he became acquainted with the Countess of Albany, who then resided with her husband at Florence. For her he

formed an attachment which, if less violent than his former loves, appears to have been more permanent. With this motive to remain at Florence, he could not endure the chains by which his vast possessions bound him to Piedmont. He therefore resigned his whole property to his sister the Countess Cumiana, reserving an annuity which scarcely amounted to a half of his original revenues. At this period the Countess of Albany, urged by the ill-treatment she received from her husband, sought refuge in Rome, where she at length received permission from the pope to live apart from her tormentor. Alfieri followed the countess to that capital, where he completed fourteen tragedies, four of which were now for the first time printed at Siena.

At length, however, it was thought proper that, by leaving Rome, he should remove the aspersions which had been thrown on the object of his affections. During the year 1783 he therefore travelled through different states of Italy, and published six additional tragedies. The interests of his love and literary glory had not diminished his rage for horses, which seems to have been at least the third passion of his soul. He came to England solely for the purpose of purchasing a number of these animals, which he carried with him to Italy. On his return he learned that the Countess of Albany had gone to Colmar in Alsace, where he joined her, and resided with her under the same roof during the rest of his life. They chiefly passed their time between Alsace and Paris, but at length took up their abode entirely in that metropolis. While here, Alfieri made arrangements with Didot for an edition of his tragedies; but was soon after forced to quit Paris by the storms of the Revolution. He recrossed the Alps with the countess, and finally settled at Florence. The last ten years of his life, which he spent at that city, seems to have been the happiest of his existence. The concluding years of his life were laudably employed in the study of the Greek literature, and in perfecting a series of comedies. His assiduous labor on this subject, which he pursued with his characteristic impetuosity, exhausted his strength, and brought on a malady for which he would not adopt the prescriptions of his physicians, but obstinately persisted in employing remedies of his own. His disorder rapidly increased, and at length terminated his life on the 8th October 1803, in the fifty-fifth year of his age.

Whatever may be the merits or defects of Alfieri, he may be considered as the founder of a new school in Italian drama. His country hailed him as her sole tragic poet; and his successors in the same path of literature have regarded his bold, austere, and rapid manner, as the genuine mode of tragic composition.

Besides his tragedies, Alfieri published during his life many sonnets, five odes on American independence, and the poem of *Etruria*, founded on the assassination of Alexander I., duke of Florence. Of his prose works the most distinguished for animation and eloquence is the *Panegyric on Trajan*, composed in a transport of indignation at the supposed feebleness of Pliny's eulogium. The two books entitled *La Tirannide* and the *Essays on Literature and Government*, are remarkable for elegance and vigor of style, but are too evidently imitations of the manner of Machiavel. His *Antigallican*, which was written at the same time with his *Defence of Louis XVI.*, comprehends an historical and satirical view of the French Revolution. The posthumous works of Alfieri consists of satires, six political comedies, and the *Memoirs of his Life*—a work which will always be read with interest, in spite of the cold and languid gravity with which he delineates the most interesting adventures and the strongest passions of his agitated life. See *Mem. di Vit. Alfieri*; Sismondi *De la Lit. du Midi de l'Europe*; Walker's

Memoir on Italian Tragedy; *Giorn. de Pisa*. tom. lviii.; *Life of Alfieri*, by Centofanti (Florence, 1842). and *Vita, Giornuli, Lettere di Alfieri*, by Teza (Florence, 1861).

ALFORD, HENRY, D.D., Dean of Canterbury, one of the most variously-accomplished churchmen of his day—poet, preacher, painter, musician, biblical scholar, critic, and philologist—was born at 25 Alfred Place, Bedford Row, London, October 7th, 1810 (died 1871). He came of a Somersetshire family, five generations of which, in direct succession, contributed clergymen of some distinction to the English Church. Being the only son of a secluded scholar, the boy's education was from an unusually early period sedulously cared for; his father being his first instructor, and at the outset his constant companion. So exceptional was his precocity that at six he had already written a little MS. volume (in round hand) entitled the *Travels of St. Paul*. Before he was eight he had penned a collection of Latin odes in miniature. When he was scarcely nine he had compiled, in the straggling characters of a school-boy, a compendious *History of the Jews*; besides drawing out a chronological scheme in which were tabulated the events of the Old Testament. Prior to the completion of his tenth year he actually produced a series of terse sermons or laconically outlined homilies, the significant title of which was *Looking unto Jesus*.

It was in the October of 1827 that the university life of Alford commenced. At seventeen he went up to Cambridge, having won his scholarship, and had his name entered at Trinity College. During the mid-summer of his fourth year at Cambridge, in the June of 1831, he had obtained the second prize essay. As the autumn deepened into winter he was nervously preparing to go in for honors at the examinations. In the possibility of his success he had not the slightest confidence, yet on the 21st January 1832 he appears as thirty-fourth wrangler; while on the 25th February his name comes out eighth on the first-class list of the classical tripos.

Resolved from childhood to tread the path of life in the footsteps of his forefathers, Alford was ordained deacon on the 26th October 1833, and at once began active professional work as curate of Ampton. So modest was his own estimate of his intellectual capabilities, that it was with unaffected surprise he found his name second on the list of the six Fellows of Trinity who were elected on the 1st of the following October. On the 6th November he was admitted to priest's orders, and four months afterwards, upon the 4th March 1835—scarcely a week before his marriage—entered upon his parochial labors of eighteen years' duration as vicar of Wymeswold in Leicestershire. Twice during the interval of his scholarly seclusion in that quiet vicarage he was vainly tempted with the offer of a colonial bishopric, first in 1841 as bishop of New Zealand, and again in 1844 as bishop of New Brunswick. He contentedly drudged on for years together in comparative obscurity among his pupils and parishioners. Whatever he put his hand to he carried out with a zeal that at times looked almost like dogged determination. Thrown from his horse in the February of 1847 when going to deliver his first lecture, although very seriously shaken and disfigured, he nevertheless punctually appeared before his audience with his face and head covered with surgical bandages, and—resolutely lectured. His reputation as a lecturer of exceptional power was within a few years from that time thoroughly established. Several of his discourses, notably one on Saul of Tarsus, with others on themes as varied as astronomy, music, scenery, and Christianity, acquired in the end certain amount of celebrity.

For two years together, in 1841 and 1842, he held the chair at Cambridge of Hulsean lecturer. As the result of his labors in that capacity, two substantial volumes afterwards made their appearance. In 1838, he edited, in six vols., the works of Donne, prefixing a luminous preface, at once critical and biographical. Throughout the year 1839 and part of 1840 he edited a monthly magazine called *Dearden's Miscellany*. In 1841 he published, with other new poems, his *Abbot of Machel-naye*. A collection of *Psalms and Hymns* appeared from his hand in the spring of 1844. A couple of years before that, in 1842, he had first entered upon his duties at Somerset House, where he acted for many years as examiner in logic and moral and intellectual philosophy in the university of London. So youthful was his appearance at the date of his first receiving this appointment, that on his entering the apartment where he was awaited by the candidates, he was mistaken for one of themselves.

A series of ingenious lectures, delivered by him in his capacity of philologist, on being compacted into a manual of idiom and usage, entitled *The Queen's English*, attained a high degree of popularity. Nevertheless, in spite of their wholly unpretentious and essentially humorous character, these mere casual notes on spelling and speaking drew down upon their author one of the sharpest criticisms he ever provoked, sarcastically entitled *The Dean's English*. The *Contemporary Review* was inaugurated under his editorship; and from January 1866 to August 1870 was conducted by him as a sort of neutral ground for religious criticism. Under the title of *The Year of Prayer*, Alfred in 1866 published a book of family devotion; and in 1867, a collection of original hymns called *The Year of Praise*, works of little pretension, but by which his name was widely popularised. His latest poetic effusion of any considerable length was *The Children of the Lord's Prayer*, which appeared in 1869 as the letterpress accompaniment to designs by F. R. Pickersgill, R.A. The miscellaneous papers he had contributed to periodicals were, the same year, collected under the name of *Essays and Addresses*. He brought out, in 1865, his *Letters from Abroad*, eminently characteristic records of travel, mainly descriptive of Italian cities and scenery; and in 1870, a collection of spirited pen and pencil sketches of *The Riviera*, the latter being reproduced from his water-color drawings by the aid of chromo-lithography.

ALFRED, or ÆLFRED, THE GREAT, the youngest son of Æthelwulf, king of the West Saxons, was born at Wantage in Berkshire in 849 A.D. At an early age he was summoned to the assistance of his brother Æthelred against the Danes. These formidable enemies, whose object hitherto had been mere plunder, were now aiming at a permanent settlement in the country, and after ravaging and subduing Northumbria, East Anglia, and the greater part of Mercia, they fell with their united forces on Wessex itself. A series of encounters took place, in which Alfred greatly distinguished himself, especially at Ashdown, where the Danes were routed with great slaughter, and left several of their most famous leaders dead on the field of battle. Æthelred dying in the midst of the struggle, Alfred was unanimously elected king (871), in the twenty-second year of his age. About a month after his accession he met the enemy at Wilton, where, after a long and doubtful struggle, he was defeated. Both parties were now becoming tired of the war. Immense loss had been suffered on both sides, and although the Danes on the whole had been victorious, their victories had brought them no substantial results. A treaty of peace was concluded, and the Danes withdrew to London.

On the cessation of hostilities, Alfred was enabled to

turn his attention to naval affairs. The sea was swarming with pirates, and their descents on the coast kept the country in a state of perpetual alarm. To cope with them successfully Alfred resolved to meet them on their own element, and a naval victory which he gained over seven Danish rovers in 875 is the first on record won by Englishmen. In the following year the peace of 871 was broken. An army of Danes from East Anglia, under their king, Guthrum, sailing along the south coast, landed in Wessex, seized upon Wareham, and afterwards upon Exeter, then the centre of a disaffected Celtic population, and it was not till 877 that the country was once more free from the invader.

The year 878 was the most eventful in the course of Alfred's reign. At mid-winter, without any warning, the Danes came pouring into Wessex from the north, seized Chippenham, and making it the centre of their operations, quickly overran the country. Many of the inhabitants, in despair, fled into foreign lands, and Alfred, totally unprepared to meet the storm, retired to the marshes of Somerset. Never at any other period, either before or after, were his fortunes so low, and the national existence itself was at stake. Had Alfred, like his kinsman Burhed of Mercia, left his people in their hour of need, the heathen Dane in all probability would have acted like the heathen Englishmen before him—a new race would have possessed the land, and the names of England and Englishmen would have disappeared from the page of history. Alfred's misfortunes only roused him to fresh exertions, and his military skill and valor enabled him to carry his people in safety through this momentous crisis. Fortifying himself at Athelney about Easter, he secretly matured his plans for meeting the enemy, and seven weeks after, having collected his forces at Brixton near Selwood, he rapidly advanced in a north-easterly direction, and was close upon the Danes before they had any intelligence of his approach. A fierce conflict ensued at Ethandun, now Edington, in which the Danes were entirely defeated; and about fourteen days after this they were compelled to sue for peace.

As soon as peace had been concluded Alfred turned his attention to the internal affairs of his kingdom. He vigorously set to work to put the country in a complete state of defence. Old fortifications were repaired and new ones raised in suitable localities. The fleet was brought into a state of greater efficiency, and it was Alfred indeed that laid the foundation of England's naval greatness. He cleared the land of the bands of robbers that infested it, and took care that justice was impartially administered to all his subjects, severely punishing any wilful perversion of it on the part of the judges. In his code of laws, which is a compilation from those of his predecessors, he wisely abstained from introducing much of his own, giving as his reason that he was afraid that it might not be accepted by posterity. He greatly encouraged commerce, and took a lively interest in geographical discovery.

Alfred's devotion to learning, and his exertions in the cause of education are among the most remarkable features of his reign. So deep was the popular ignorance when Alfred ascended the throne that, according to his own testimony, hardly any one south of the Thames could understand the ritual of the church or translate a Latin letter.

In occupations such as these fifteen years of comparative tranquillity, disturbed now and then by troubles with the Danes, passed away. A fresh swarm from abroad had landed in Kent in 885 and besieged Rochester, but on the king's approach they raised the siege and returned to their ships. The next eight years were years of uninterrupted peace; but the Danes, suffering a severe defeat at

the hands of Arnulf, king of the East Franks, sailed for England in two divisions in 893. One of these divisions was under the command of the terrible Hastings. Their arrival was a signal to the Danes of Northumbria and East Anglia, who rose in great numbers to aid their kinsmen. Alfred, however, was better prepared to meet the danger than he had formerly been. His towns were so strong that the Danes seemed studiously to have avoided them. A body of the enemy was routed by Alfred at Farnham in Surrey. Another great host, moving to the west in the lines of the Thames, was followed by three of Alfred's aldermen to Buttington in Montgomeryshire, and completely defeated. Those who escaped made their way to Essex. Leaving their wives and children there, and receiving considerable addition to their numbers, they crossed the country once more and established themselves within the fortifications of the old Roman town of Chester, which was then uninhabited. There they remained for the winter, when, provisions failing them, they removed to Wales, and with the harvest of plunder they gathered there they retreated into Essex by way of the friendly districts of Northumbria and East Anglia. So rapid had their movements been that Alfred's army was unable to keep up with them. The same year (895), before-winter set in, the Danes sailed up the Thames into the Lea, and selecting an advantageous position on the banks of the latter stream, constructed a fortress about 20 miles above London. As this proved a considerable annoyance to the citizens, they attacked it the following summer, but were repulsed with great loss. During harvest the king was obliged to encamp in the neighborhood of the city to protect the reapers while gathering their crops. He afterwards raised two forts on each side of the Lea, and so effectually blocked up the passage of the river that the enemy abandoned their vessels and proceeded to Bridgenorth on the Severn. In the summer of 897 the great Danish host broke up, and part of them returned to the continent. The rest dispersed through Northumbria and East Anglia, and for some time gave Alfred no little trouble by their piratical excursions. By means of vessels formed after a model of his own, of unusual length and speed, he succeeded at last in curbing his Danish foes, but not till after a desperate encounter with them on the south coast, in which the advantage was not all on his side. The war was, as usual, accompanied by pestilence, and great numbers perished, many being persons of the highest rank in the state. The rest of Alfred's reign, about which we know almost nothing, seems to have been passed in peace. He died in the year 901, at the age of fifty-two, and was buried at Winchester.

ALGÆ, or HYDROPHYTA, a large order of cellular, flowerless, cryptogamic plants, found in the sea (seaweeds), in rivers, lakes, marshes, hot springs, and moist places, all over the world. They consist of a brown, red, or green, flattened, cellular, leaf-like expansion, called a *thallus*, sometimes stalked, which bears the organs of reproduction. Some have root-like processes by which they are attached to rocks. These do not act like the nourishing roots of flowering plants; they simply fix the plants and enable them to sway about in the water. This is markedly the case with the Laminarias, or large tangles of our coasts. The leafy appendages of seaweeds are called fronds. They vary in size, color, and consistence. Some of the red and green delicate fronds form beautiful objects when carefully dried and laid out on drawing-paper. In order to dry seaweeds they must be first washed carefully in fresh water to separate saline matters, and then place within drying-paper and subjected to pressure. Very delicate seaweeds should be floated out in water, draw-

ing-paper being placed under them, and their fronds being carefully arranged on the paper before they are raised out of the water. They must then be dried partially in the air, and afterwards under pressure between sheets of drying-paper.

Seaweeds are composed entirely of cells, which in some instances become elongated so as to have the appearance of tubes. Some Algæ are uni-cellular, that is, are composed of a single cell, as occurs in some Desmidiæ, as Closterium. At other times they are composed of numerous cells, which are kept together by a gelatinous matter, but separating easily from each other so as to have an independent existence. This is observed in the red snow plant (*Protococcus* or *Palmella vivalis*). The cells of seaweeds are sometimes joined together so as to form a linear series, and to give them a thread-like appearance; and in such a case, when the divisions between the cells are marked, the whole appears like a beaded necklace of cells. When the cells are united both lengthwise and laterally they then form an expanded flat frond. In some instances the frond is gelatinous.

ALGARDI, ALESSANDRO, one of the most celebrated sculptors of Italy, was born at Bologna in 1602, and died in 1654. While he was attending the school of the Caracci his preference for the plastic art became evident, and he placed himself under the instruction of the sculptor Conventi.

ALGAROTTI, FRANCESCO, COUNT, was born at Venice on the 11th December 1712. He went abroad in his youth, and in 1733 visited Paris, where he issued his Newtonian Philosophy for the Ladies, in the work entitled *The Plurality of Worlds*. He was much honored by Frederick the Great, who, in 1740, created him a count of Prussia. He died in 1764.

ALGARVE, the most southerly province of Portugal, is bounded on the east by the Spanish province of Seville, from which it is separated by the river Guadiana; on the north by Alemtejo; and on the west and south by the Atlantic Ocean. Its length from east to west is 85 miles, the average width is 22 miles, and the area, according to the most recent measurement, 1,865 square miles. In 1900 the population was 254,851, giving the small proportion of 136.0 to the square mile.

The name of Algarve is derived from the Arabic, and signifies a land lying to the west. The province was taken from the Moors in 1253 by Alphonso III., king of Portugal, who then assumed the additional title of king of Algarve. It is sometimes designated the district of Faro, and is subdivided into fifteen communes and sixty-two parishes. The chief town is Faro, and among the other towns are Castro Marino, Tavira, Portimao, Lagos, and Sagres, all on the coast or on the estuaries of the rivers, and Silves, on the river Portimao, the ancient Moorish capital of Algarve.

ALGAU, or ALLGAU, the name now given to a comparatively small district forming the south-western corner of Bavaria, and belonging to the province of Swabia and Neuburg, but formerly applied to a much larger territory, which extended as far as the Danube on the north, the Inn on the south, and the Lech on the west.

AL-GAZALI, ABU HAMED MUHAMMAD, usually described as an Arabian philosopher, was really a Moslem theologian who met the heretical philosophers on their own ground. He was born in 1058, and belonged to the sect of the Ascharites, or extreme right of the Motecallemin, who (and not the philosophers) were the real Arabian school-men. At thirty-three he became the head of a theological college at Baghdad, where his professor's chair was surrounded by eager crowds, including all the imams of the country. It was

a time of keen speculation, when philosophic scepticism was encouraged in high places; and the premature convictions of Al-Gazali gave way under a violent reaction against the orthodox creed. Driven by mental iniquitude, he escaped from Baghdad on the plea of making a pilgrimage to Mecca, but went to Syria, and (after visiting, though a Mahometan, the Holy Sepulchre at Jerusalem) settled at Damascus, where he spent ten years in seclusion and meditation. Recalled by his private affairs as he was on his way to Egypt, he returned to Baghdad, reluctantly resumed teaching (which he continued for fifteen years), then retired to Tous, his native town, and devoted his remaining years to the contemplative life of the Sufis, who had been his earliest instructors. He died in 1111.

ALGEBRA. Algebra is that branch of the mathematical sciences which has for its object the carrying on of operations either in an order different from that which exists in arithmetic, or of a nature not contemplated in fixing the boundaries of that science. The circumstance that algebra has its origin in arithmetic, however widely it may in the end differ from that science, led Sir Isaac Newton to designate it "Universal Arithmetic," a designation which, vague as it is, indicates its character better than any other by which it has been attempted to express its functions—better certainly, to ordinary minds, than the designation which has been applied to it by Sir William Rowan Hamilton, one of the greatest mathematicians the world has seen since the days of Newton—"the Science of Pure Time;" or even than the title by which De Morgan would paraphrase Hamilton's words—"the Calculus of Succession."

To express in a few words what it is which effects the transition from the science of arithmetic into a new field is not easy. It will serve, probably, to convey some notion of the position of the boundary line, when it is stated that the operations of arithmetic are all capable of direct interpretation *per se*, whilst those of algebra are in many cases interpretable only by comparison with the assumptions on which they are based. For example, multiplication of fractions—which the older writers on arithmetic, Lucas de Burgo in Italy, and Robert Recorde in England, clearly perceived to be a new application of the term multiplication, scarcely at first sight reconcilable with its original definition as the exponent of equal additions,—multiplication of fractions becomes interpretable by the introduction of the idea of multiplication into the definition of the fraction itself. On the other hand, the independent use of the sign *minus*, on which Diophantus, in the 4th century, laid the foundation of the science of algebra in the West, by placing in the forefront of his treatise, as one of his earliest definitions, the rule of the sign *minus*, "that *minus* multiplied by *minus* produced *plus*"—this independent use of the sign has no originating operation of the same character as itself, and might, if assumed in all its generality as existing side by side with the laws of arithmetic, more especially with the commutative law, have led to erroneous conclusions. As it is, the unlimited applicability of this definition, in connection with all the laws of arithmetic standing in their integrity, pushes the dominion of algebra into a field on which the oldest of the Greek arithmeticians, Euclid, in his unbending march, could never have advanced a step without doing violence to his convictions.

In asserting that the independent existence of the sign *minus*, side by side with the laws of arithmetic, might have led to anomalous results, had not the operations been subject to some limitation, we are introducing no imaginary hypothesis, but are referring to a fact actually existing. The most recent advance beyond the

boundaries of algebra, as it existed fifty years ago, is that beautiful extension to which Sir W. R. Hamilton has given the designation of Quaternions, the very foundation of which requires the removal of one of the ancient axioms of arithmetic, "that operations may be performed in any order."

HISTORY.

At what period and in what country algebra was invented? is a question that has been much discussed. Who were the earliest writers on the subject? What was the progress of its improvement? And lastly, by what means and at what period was the science diffused over Europe? It was a common opinion in the 17th century that the ancient Greek mathematicians must have possessed an analysis of the nature of modern algebra, by which they discovered the theorems and solutions of the problems which we so much admire in their writings; but that they carefully concealed their instruments of investigation, and gave only the results, with synthetic demonstrations.

This opinion is, however, now exploded. A more intimate acquaintance with the writings of the ancient geometers has shown that they had an analysis, but that it was purely geometrical, and essentially different from our algebra.

Although there is no reason to suppose that the great geometers of antiquity derived any aid in their discoveries from the algebraic analysis, yet we find that at a considerably later period it was known to a certain extent among the Greeks.

About the middle of the 4th century of the Christian era, a period when the mathematical sciences were on the decline, and their cultivators, instead of producing original works of genius, contented themselves with commentaries on the works of their more illustrious predecessors, there was a valuable edition made to the fabric of ancient learning.

This was the treatise of Diophantus on arithmetic, consisting originally of thirteen books, of which only the first six, and an incomplete book on polygonal numbers, supposed to be the thirteenth, have descended to our times.

This precious fragment does not exhibit anything like a complete treatise on algebra. It lays, however, an excellent foundation of the science, and the author, after applying his method to the solution of simple and quadratic equations, such as to "find two numbers of which the sum and the sum or difference of the squares are given," proceeds to a peculiar class of arithmetical questions, which belong to what is now called the indeterminate analysis.

Diophantus may have been the inventor of the Greek algebra, but it is more likely that its principles were not unknown before his time; and that, taking the science in the state in which he found it as the basis of his labors, he enriched it with new applications. The elegant solutions of Diophantus show that he possessed great address in the particular branch of which he treated, and that he was able to resolve determinate equations of the second degree. Probably this was the greatest extent to which the science had been carried among the Greeks. Indeed, in no country did it pass this limit, until it had been transplanted into Italy on the revival of learning.

The celebrated Hypatia, the daughter of Theon, composed a commentary on the work of Diophantus. This, however, is now lost, as well as a similar treatise, on the *Conics* of Apollonius, by this illustrious and ill-fated lady, who, as is commonly known, fell a sacrifice to the fury of a fanatical mob about the beginning of the 5th century.

About the middle of the 16th century, the work of

Diophantus above referred to, written in the Greek language, was discovered at Rome in the Vatican library, having probably been brought there from Greece when the Turks possessed themselves of Constantinople. A Latin translation, without the original text, was given to the world by Xylander in 1575; and a more complete translation, by Bachet de Mezeriac (one of the earliest members of the French Academy), accompanied by a commentary, appeared in 1621. Bachet was eminently skilful in the indeterminate analysis, and therefore well qualified for the work he had undertaken; but the text of Diophantus was so much injured, that he was frequently obliged to guess the meaning of the author, or supply the deficiency. At a later period, the celebrated French mathematician, Fermat, supplemented the commentary of Bachet by notes of his own on the writings of the Greek algebraist. These are extremely valuable, on account of Fermat's profound knowledge of this particular branch of analysis. This edition, the best which exists, appeared in 1670.

Although the revival of the writings of Diophantus was an important event in the history of mathematics, yet it was not from them that algebra became first known in Europe. This important invention, as well as the numeral characters and decimal arithmetic, was received from the Arabians. That ingenious people fully appreciated the value of the sciences; for at a period when all Europe was enveloped in the darkness of ignorance, they preserved from extinction the lamp of knowledge. They carefully collected the writings of the Greek mathematicians; they translated them into their language, and illustrated them with commentaries. It was through the medium of the Arabic tongue that the elements of Euclid were first introduced into Europe; and a part of the writings of Apollonius are only known at the present day by a translation from the Arabic, the Greek original being lost.

The Arabians ascribe the invention of their algebra to one of their mathematicians, Mahommed-ben-Musa, or Moses, called also Mahommed of Buziana, who flourished about the middle of the 9th century, in the reign of the Caliph Almamoun.

It is certain that this person composed a treatise on this subject, because an Italian translation was known at one time to have existed in Europe, although it is now lost. Fortunately, however, a copy of the Arabic original is preserved in the Bodleian Library at Oxford, bearing a date of transcription corresponding to the year 1342. The title-page identifies its author with the ancient Arabian. A marginal note concurs in this testimony, and further declares the work to be the first treatise composed on algebra among the faithful; and the preface, besides indicating the author, intimates that he was encouraged by Almamoun, commander of the faithful, to compile a compendious treatise of calculation by algebra.

The circumstances of this treatise professing to be only a compilation, and, moreover, the first Arabian work of the kind, has led to an opinion that it was collected from books in some other language. As the author was intimately acquainted with the astronomy and computations of the Hindoos, he may have derived his knowledge of algebra from the same quarter. The Hindoos, as we shall presently see, had a science of Algebra, and knew how to solve indeterminate problems. Hence we may conclude, with some probability, that the Arabian algebra was originally derived from India.

The algebraic analysis, having been once introduced among the Arabians, was cultivated by their own writers. One of these, Mahommed Abulwafa, who flourished in the last forty years of the 10th century, composed commentaries on the writers who had pre-

ceded him. He also translated the writings of Diophantus.

It is remarkable, that although the mathematical sciences were received with avidity, and sedulously cultivated during a long period by the Arabians, yet in their hands they received hardly any improvement. It might have been expected that an acquaintance with the writings of Diophantus would have produced some change in their algebra. This, however, did not happen: their algebra continued nearly in the same state, from their earliest writer on the subject, to one of their latest, Behaudin, who lived between the years 953 and 1031.

Writers on the history of algebra were long under a mistake as to the time and manner of its introduction into Europe. It has now, however, been ascertained that the science was brought into Italy by Leonardo, a merchant of Pisa. This ingenious man resided in his youth in Barbary, and there learned the Indian method of counting by the nine numeral characters. Commercial affairs led him to travel into Egypt, Syria, Greece, and Sicily, where we may suppose he made himself acquainted with everything known respecting numbers. The Indian mode of computation appeared to him to be by far the best. He accordingly studied it carefully; and, with this knowledge, and some additions of his own, and also taking some things from Euclid's Geometry, he composed a treatise on arithmetic. At that period algebra was regarded only as a part of arithmetic. It was indeed the sublime doctrine of that science; and under this view the two branches were handled in Leonardo's treatise, which was originally written in 1202, and again brought forward under a revised form in 1228. When it is considered that this work was composed two centuries before the invention of printing, and that the subject was not such as generally to interest mankind, we need not wonder that it was but little known; hence it has always remained in manuscript, as well as some other works by the same author. Indeed it is not known to exist from an early period until the middle of the last century, when it was discovered in the Magliabecchian library at Florence.

The extent of Leonardo's knowledge was pretty much the same as that of the preceding Arabian writers. He could resolve equations of the first and second degrees, and he was particularly skilful in the Diophantine analysis. He was well acquainted with geometry, and he employed its doctrines in demonstrating his algebraic rules. Like the Arabian writers, his reasoning was expressed in words at length; a mode highly unfavorable to the progress of the art. The use of symbols, and the method of combining them so as to convey to the mind at a single glance a long process of reasoning, was a much later invention.

Considerable attention was given to the cultivation of algebra between the time of Leonardo and the invention of printing. It was publicly taught by professors. Treatises were composed on the subject; and two works of the oriental algebraists were translated from the Arabian language into Italian. One was entitled *the Rule of Algebra*, and the other was the oldest of all the Arabian treatises, that of Mahommed-ben-Musa of Corasan.

The earliest printed book on algebra was composed by Lucas Pacioli, or Lucas de Burgo, a minorite friar. It was first printed in 1494, and again in 1523. The title is *Summa de Arithmetica, Geometria, Proportioni, et Proportionalita*.

This is a very complete treatise on arithmetic, algebra, and geometry, for the time in which it appeared. The author followed close on to the steps of Leonardo; and, indeed, it is from this work that one of his lost treatises has been restored.

Lucas de Burgo's work is interesting, inasmuch as it shows the state of algebra in Europe about the year 1500; probably the state of the science was nearly the same in Arabia and Africa, from which it had been received.

The power of algebra as an instrument of research is in a very great degree derived from its notation, by which all the quantities under consideration are kept constantly in view; but in respect of convenience and brevity of expression, the algebraic analysis in the days of Lucas de Burgo was very imperfect; the only symbols employed were a few abbreviations of the words or names which occurred in the processes of calculation, a kind of short-hand, which formed a very imperfect substitute for that compactness of expression which has been attained by the modern notation.

The application of algebra was also at this period very limited; it was confined almost entirely to the resolution of certain questions of no great interest about numbers. No idea was then entertained of that extensive application which it has received in modern times.

The knowledge which the early algebraists had of their science was also circumscribed; it extended only to the resolution of equations of the first and second degrees; and they divided the last into cases, each of which was resolved by its own particular rule. The important analytical fact, comprehended in a single formula, which may be obtained from the solution of one of its own cases, merely by a change of the sign, was not then known; indeed, it was long before this principle was fully comprehended. Dr. Halley expresses surprise, that a formula in optics which he had found, should by a mere change of the signs give the focus of both converging and diverging rays, whether reflected or refracted by convex or concave specula or lenses; and Molyneux speaks of the universality of Halley's formula as something that resembled magic.

The rules of algebra may be investigated by its own principles, without any aid from geometry; and although in some cases the two sciences may serve to illustrate each other, there is not now the least necessity in the more elementary parts to call in the aid of the latter in expounding the former. It was otherwise in former times. Lucas de Burgo found it to be convenient, after the example of Leonardo, to employ geometrical constructions to prove the truth of his rules for resolving quadratic equations, the nature of which he did not completely comprehend; and he was induced by the imperfect nature of his notation to express his rules in Latin verses, which will not now be read with the kind of satisfaction we receive from the perusal of the well-known poem, "the Loves of the Triangles."

As Italy was the first European country where algebra became known, it was there that it received its earliest improvements. The science had been nearly stationary from the days of Leonardo to the time of Pacioli, a period of three centuries; but the invention of printing soon excited a spirit of improvement in all the mathematical sciences. Hitherto an imperfect theory of quadratic equations was the limit to which it had been carried. At last this boundary was passed, and about the year 1505 a particular case of equations of the third degree was resolved by Scipio Ferreus, a professor of mathematics in Bononia. This was an important step, because it showed that the difficulty of resolving equations of the higher orders, at least in the case of the third degree, was not insurmountable, and a new field was opened for discovery. It was then the practice among the cultivators of algebra, when they advanced a step, to conceal it carefully from their contemporaries, and to challenge them to resolve arithmetical questions, so framed as to require for their solution a knowledge of

their own new-found rules. In this spirit did Ferreus make a secret of his discovery: he communicated it, however, to a favorite scholar, a Venetian named Florido. About the year 1535 this person, having taken up his residence at Venice, challenged Tartalea of Brescia, a man of great ingenuity, to a trial of skill in the resolution of problems by algebra. Florido framed his questions so as to require for their solution a knowledge of the rule which he had learned from his preceptor Ferreus; but Tartalea had, five years before this time, advanced further than Ferreus, and was more than a match for Florido. He therefore accepted the challenge, and a day was appointed when each was to propose to the other thirty questions. Before the time came, Tartalea had resumed the study of cubic equations, and had discovered the solution of two cases in addition to two which he knew before. Florido's questions were such as could be resolved by the single rule of Ferreus while, on the contrary, those of Tartalea could only be resolved by one or other of three rules, which he himself had found, but which could not be resolved by the remaining rule, which was also that known to Florido. The issue of the contest is easily anticipated; Tartalea resolved all his adversary's questions in two hours, without receiving one answer from him in return.

The celebrated Cardan was a contemporary of Tartalea. This remarkable person was a professor of mathematics at Milan, and a physician. He had studied algebra with great assiduity, and had nearly finished the printing of a book on arithmetic, algebra and geometry; but being desirous of enriching his work with the discoveries of Tartalea, which at that period must have been the object of considerable attention among literary men in Italy, he endeavored to draw from him a disclosure of his rules. Tartalea resisted for a time Cardan's entreaties. At last, overcome by his importunity, and his offer to swear on the holy Evangelists, and by the honor of a gentleman, never to publish them, and on his promising on the faith of a Christian to commit them to cypher so that even after his death they would not be intelligible to any one, he ventured with much hesitation to reveal to him his practical rules, which were expressed by some very bad Italian verses, themselves in no small degree enigmatical. He reserved, however, the demonstrations. Cardan was not long in discovering the reason of the rules, and he even greatly improved them, so as to make them in a manner his own. From the imperfect essays of Tartalea he deduced an ingenious and systematic method of resolving all cubic equations whatsoever; but with a remarkable disregard for the principles of honor, and the oath he had taken, he published in 1545 Tartalea's discoveries, combined with his own, as a supplement to a treatise on arithmetic and algebra, which he had published six years before. This work is remarkable for being the second printed book on algebra known to have existed.

In the following year Tartalea also published a work on algebra, which he dedicated to Henry VIII., king of England.

It is to be regretted that in many instances the authors of important discoveries have been overlooked, while the honors due to them have been transferred to others having only secondary pretensions. The formulæ for the resolution of cubic equations are now called Cardan's rules, notwithstanding the prior claim of Tartalea. It must be confessed, however, that he evinced considerable selfishness in concealing his discovery; and although Cardan cannot be absolved from the charge of bad faith, yet it must be recollected that by his improvements in what Tartalea communicated to him, he made the discovery in some measure his own; and he had moreover

the high merit of being the first to publish this important improvement in algebra to the world.

The next step in the progress of algebra was the discovery of a method of resolving equations of the fourth order. An Italian algebraist had proposed a question which could not be resolved by the newly invented rules, because it produced a biquadratic equation. Some supposed that it could not be resolved at all; but Cardan was of a different opinion. He had a pupil named Lewis Ferrari, a young man of great genius, and an ardent student in the algebraic analysis: to him Cardan committed the solution of this difficult question, and he was not disappointed. Ferrari not only resolved the question, but he also found a general method of resolving equations of the fourth degree, by making them depend on the solution of equations of the third degree.

This was another great improvement; and although the precise nature of an equation was not then fully understood, nor was it indeed until half a century later, yet, in the general resolution of equations, a point of progress was then reached which the utmost efforts of modern analysis have never been able to pass.

There was another Italian mathematician of that period who did something for the improvement of algebra. This was Bombelli. He published a valuable work on the subject in 1572, in which he brought into one view what had been done by his predecessors. He explained the nature of the *irreducible case* of cubic equations, which had greatly perplexed Cardan, who could not resolve it by his rule; he showed that the rule would apply sometimes to particular examples, and that all equations of this case admitted of a real solution; and he made the important remark, that the algebraic problem to be resolved in this case corresponds to the ancient problem of the trisection of an angle.

There were two German mathematicians contemporary with Cardan and Tartalea, viz., Stifelius and Scheubelius. Their writings appeared about the middle of the 16th century, before they knew what had been done by the Italians. Their improvements were chiefly in the notation. Stifelius, in particular, introduced for the first time the characters which indicate addition and subtraction, and the symbol for the square root.

The first treatise on algebra in the English language was written by Robert Recorde, teacher of mathematics and practitioner in physic at Cambridge. At this period it was common for physicians to unite with the healing art the studies of mathematics, astrology, alchemy, and chemistry. This custom was derived from the Moors, who were equally celebrated for their skill in medicine and calculation. In Spain, where algebra was early known, the title of physician and algebraist were nearly synonymous. Accordingly, in the romance of Don Quixote, when the bachelor Samson Carasco was grievously wounded in his encounter with the knight, an *algebrista* was called in to heal his bruises.

Recorde published a treatise on arithmetic, which was dedicated to Edward VI.; and another on algebra, with the title, *The Whetstone of Wit*, &c. Here, for the first time, the modern sign for equality was introduced.

By such gradual steps did algebra advance in improvement from its first introduction by Leonardo, each succeeding writer making some change for the better; but with the exception of Tartalea, Cardan, and Ferrari, hardly any one rose to the rank of an inventor. At length came Vieta, to whom this branch of mathematical learning, as well as others, is highly indebted. His improvements in algebra were very considerable; and some of his inventions, although not then fully de-

veloped, have yet been the germs of later discoveries. He was the first that employed general characters to represent known as well as unknown quantities. Simple as this step may appear, it has yet led to important consequences. He must also be regarded as the first that applied algebra to the improvement of geometry. The older algebraists had indeed resolved geometrical problems, but each solution was particular; whereas Vieta, by introducing general symbols, produced general formulae, which were applicable to all problems of the same kind, without the trouble of going over the same process of analysis for each.

This happy application of algebra to geometry produced great improvements; it led Vieta to the doctrine of angular sections, one of the most important of his discoveries, which is now expanded into the arithmetic of sines or analytical trigonometry. He also improved the theory of algebraic equations, and he was the first that gave a general method of resolving them by approximation. As he lived between the years 1540 and 1603, his writings belong to the latter half of the 16th century. He printed them at his own expense, and liberally bestowed them on men of science.

The Flemish mathematician Albert Girard was one of the improvers of algebra. He extended the theory of equations somewhat further than Vieta, but he did not completely unfold their composition; he was the first that showed the use of the negative sign in the resolution of geometrical problems, and the first to speak of *imaginary quantities*. He also inferred by induction that every equation has precisely as many roots as there are units in the number that expresses its degree. His algebra appeared in 1629.

The next great improver of algebra was Thomas Harriot, an Englishman. As an inventor he has been the boast of this country. The French mathematicians have accused the British of giving discoveries to him which were really due to Vieta. It is probable that some of these may be justly claimed for both, because each may have made the discovery for himself, without knowing what had been done by the other. Harriot's principal discovery, and indeed the most important ever made in algebra, was, that every equation may be regarded as formed by the product of as many simple equations as there are units in the number expressing its order. This important doctrine, now familiar to every student of algebra, developed itself slowly. It was quite within the reach of Vieta, who unfolded it in part, but left its complete discovery to Harriot.

We have seen the very inartificial form in which algebra first appeared in Europe. The improvements of almost 400 years had not given its notation that compactness and elegance of which it is susceptible. Harriot made several changes in the notation, and added some new signs: he thus gave to algebra greater symmetry of form. Indeed, as it came from his hands, it differed but little from its state at the present time.

Oughtreed, another early English algebraist, was a contemporary with Harriot, but survived long after him. He wrote a treatise on the subject, which was long taught in the universities.

In tracing the history of algebra, we have seen, that in the form under which it was received from the Arabs, it was hardly distinguishable as a peculiar mode of reasoning, because of the want of a suitable notation; and that, poor in its resources, its applicability was limited to the resolution of a small number of uninteresting numeral questions. We have followed it through different stages of improvement, and we are now arrived at a period when it was to acquire additional power as an instrument of analysis, and to admit of new and more extended applications. Vieta saw

the great advantage that might be derived from the application of algebra to geometry. The essay he made in his theory of angular sections, and the rich mine of discovery thus opened, proved the importance of his labors. He did not fully explore it, but it has seldom happened that one man began and completed a discovery. He had, however, an able and illustrious successor in Descartes, who, employing in the study of algebra that high power of intellect with which he was endowed, not only improved it as an abstract science, but, more especially by its application to geometry, laid the foundation of the great discoveries which have since so much engaged mathematicians, and have made the last two centuries ever memorable in the history of the progress of the human mind.

Descartes' grand improvement was the application of algebra to the doctrine of curve lines. As in geography we refer every place on the earth's surface to the equator, and to a determinate meridian, so he referred every point of a curve to some line given by position. For example, in a circle, every point in the circumference might be referred to the diameter. The perpendicular from any point in the curve, and the distance of that perpendicular from the centre or from the extremity of a diameter, were lines which, although varying with every change of position in the point from which the perpendicular was drawn, yet had a determinate relation to each other, which was the same for all points in the curve depending on its nature, and which, therefore, served as a characteristic to distinguish it from all other curves.

The relations of lines drawn in this way could be readily expressed in algebraic symbols; and the expression of this relation in general terms constituted what is called the *equation* of the curve.

This might serve as its definition; and from the equation by the processes of algebra, all the properties of the curve could be investigated.

Descartes' *Geometry* (or, as it might have been named, the application of algebra to geometry) appeared first in 1637. This was six years after the application of Harriot's discoveries, which was a posthumous work. Descartes availed himself of some of Harriot's views, particularly the manner of generating an equation, without acknowledgment: and on this account Dr. Wallis, in his algebra, has reflected with considerable severity on the French algebraist. This spirit has engendered a corresponding eagerness in the French mathematicians to defend him. Montucla, in his history of the mathematics, has evinced a strong national prejudice in his favor; and, as usually happens, in order to exalt him, he hardly does justice to Harriot, the idol of his adversaries.

The new views which the labors of Vieta, Harriot, and Descartes opened in geometry and algebra were seized with avidity by the powerful minds of men eager in the pursuit of real knowledge. Accordingly, we find in the 17th century a whole host of writers on algebra, or algebra combined with geometry.

Our limits will not allow us to enter minutely into the claims which each has on the gratitude of posterity. Indeed, in pure algebra the new inventions were not so conspicuous as the discoveries made by its applications to geometry, and the new theories which were suggested by their union. The curious speculation of Kepler concerning the solids formed by the revolutions of curvilinear figures, the Geometry of Indivisibles by Cavalieri, the Arithmetic of Infinites of Wallis, and, above all, the Method of Fluxions of Newton, and the Differential and Integral Calculus of Leibnitz, are fruits of the happy union. All these were agitated incessantly by their inventors and contemporaries; by such men as Barrow, James Gregory, Wren, Cotes, Taylor, Halley, De Moivre, Maclaurin, Stirling, and others, in

this country; and abroad by Roberval, Fermat, Huyghens, the two Bernoullis, Pascal, and many others.

The first half of the 18th century produced little in the way of addition either to pure algebra or to its applications. Men were employed rather in elaborating and working out what Newton, Leibnitz, and Descartes had originated, than in exercising themselves in independent investigations. There are, indeed, to be found some names of eminence associated with the science of algebra, such as Maclaurin, but their eminence will be found to depend on their connection with the extension of the science, rather than with the science itself. It was reserved for Lagrange, in the latter part of the century, to give a new impulse to extension in pure algebra, in a direction which has led to most important results. Not only did he, in his *Traité de la Résolution des Equations Numériques*, lay the foundation on which Budan, Fourier, Sturm, and others, have built a goodly fabric after the pattern of the *Universal Arithmetic* of Newton, but in his *Théorie des fonctions analytiques*, and *Calcul des fonctions*, he endeavored, and with a large amount of success, to reduce the higher analysis (the Fluxions of Newton), to the domain of pure algebra. Nor must the labors of a fellow-workman, Euler, be forgotten. In his voluminous and somewhat ponderous writings will be found a perfect storehouse of investigations on every branch of algebraical and mechanical science. Especially pertinent to our present subject in his demonstration of the Binomial Theorem in the *Novi Commentarii*, vol. xix., which is probably the original of the development that Lagrange makes the basis of his analysis (*Calcul des fonctions*, leçon seconde), and which for simplicity and generality leaves nothing to be desired.

This brings the history down to the close of the last century. We have been as copious as our limits would permit on the early history, because it presents the interesting spectacle of the progress of a science from an almost imperceptible beginning, until it has attained a magnitude too great to be fully grasped by the human mind.

It will be seen from what precedes, that we have not limited "algebra" to the pure science, but have retained the name when it has encroached on the territories of geometry, trigonometry, and the higher analysis. To continue to trace its course through all these branches during the present century, when it has extended into new directions within its own borders, would far exceed the limits of an introductory sketch like the present. We must, therefore, necessarily limit ourselves to what has been done in the Theory of Equations (which may be termed algebra proper), and in Determinants.

Theory of Equations.—That every numerical equation has a root—that is some quantity in a numerical form, real or imaginary, which when substituted for the unknown quantity in the equation, shall render the equation a numerical identity—appears to have been taken for granted by all writers down to the time of Lagrange. It is by no means self-evident, nor is it easy to afford evidence for it which shall be at the same time convincing and free from limitations. The demonstrations of Lagrange, Gauss, and Ivory, have for simplicity and completeness given way to that of Cauchy.

published first in the *Journal de l'École Polytechnique* and subsequently in his *Cours d'Analyse Algébrique*

The demonstration of Cauchy (which had previously been given by Argand, though in an imperfect form, in *Gergonne's Annales des Mathématiques*, vol. v.) consists in showing that the quantity which it is wished to prove capable of being reduced to zero, can be exhibited as the product of two factors, one of which is

incapable of assuming a minimum value, or in other words, that a less value than one assigned can always be found, and therefore that it is capable of acquiring the value zero. This argument, if not absolutely free from objection, is less objectionable than any of the others. The reader may consult papers by Airy and De Morgan, in the tenth volume of the *Transactions of the Cambridge Philosophical Society*.

Admitting, then, that every equation has a root, it becomes a question to what extent are we in possession of an analysis by which the root can be ascertained. If the question be put absolutely, we fear the answer must be, that in this matter we are in the same position that we have held for the last three centuries. Cubic and biquadratic equations can be solved, whatever they may be; but equations of higher orders, in which there exists no relation amongst the several coefficients, and no known or assumed connection between the different roots, have baffled all attempts at their solution. Much skill and ingenuity have been displayed by writers of more or less eminence in the attempt to elaborate a method of solution applicable to equations of the fifth degree, but they have failed; whether it be that, like the ancient problems of the quadrature of the circle, and the duplication of the cube, an absolute solution is an impossibility, or whether it is reserved for future mathematicians to start in the research in some new path, and reach the goal by avoiding the old tracks which appear to have been thoroughly traversed in vain.

It is scarcely necessary to refer to such writers as Hoene de Wronski, who, in 1811, announced a general method of solving all equations, giving formulæ without demonstration. In 1817, the Academy of Sciences of Lisbon proposed as the subject of a prize, the *demonstration* of Wronski's formulæ. The prize was in the following year awarded to M. Torriani for the refutation of them.

The reader will find in the fifth volume of the *Reports of the British Association*, an elaborate report by Sir W. R. Hamilton on a Method of Decomposition, proposed by Mr. G. B. Jerrard in his *Mathematical Researches*, published at Bristol in a work of great beauty and originality, but which Hamilton is compelled to conclude fails to effect the desired object. In fact, the method which is valid when the proposed equation is itself of a sufficiently elevated degree, fails to reduce the solution of the equation of the fifth degree to that of the fourth.

But although the absolute solution of equations of higher orders than the fourth remains amongst the things uneffected, and rather to be hoped for than expected, a very great deal has been done towards preparing the way for approximate, if not for absolute solutions.

In the first place, equations of the higher orders, when they assume certain forms, have been shown to be capable of solution. An equation of this kind, to all appearance of a very general and comprehensive form, had been solved by de Moivre in the *Philosophical Transactions* for 1737. Binomial equations had advanced under the skilful hands of Gauss, who, in his *Disquisitiones Arithmeticae*, which appeared in 1801, added largely to what had been done by Vandermonde in the classification and solution of such equations; and subsequently, Abel, a mathematician of Norwegian birth, who died too early for science, completed and extended what Gauss had left imperfect. The collected writings of Abel published at Christiania in 1839, contain original and valuable contributions to this and many other branches of mathematics.

But it is not in the solution of equations of certain forms that the greatest advance has been made during

the present century. The basis of all methods of solution must evidently be found in the previous separation of the roots, and the efforts of the mathematicians have been directed to the discovery of methods of effecting this. The object is not so much to classify the roots into positive and negative, real and imaginary, as to determine the situation and number of the real roots of the equation. The first writer on the subject whose methods appeared in print is Budan, whose treatise, entitled *Nouvelle méthode pour la résolution des équations numériques*, appeared in 1807. But there is evidence that Fourier had delivered lectures on the subject prior to the publication of Budan's work, and consequently, without detriment to the claims of Budan, we may admit that the most valuable and original contribution to the science is to be found in Fourier's posthumous work, published by Navier in 1831, entitled *Analyse des équations déterminées*. The theorem which Fourier gave for the discovery of the position, within narrow limits, of a root of an equation, is one of two theorems, each of which is known by mathematicians as "Fourier's Theorem." The other is a theorem of integration, and occurs in the author's magnificent work *Théorie de la Chaleur*. During the interval between the publication of Budan's work and that of Fourier, there appeared a paper in the *Philosophical Transactions of the Royal Society* for 1819, by W. G. Horner, upon a new method of solving arithmetical equations. From its being somewhat obscurely expressed, the great originality of the memoir did not at once appear. Gradually, however, Mr. Horner's method came to be appreciated, and it now ranks as one of the best processes, approaching, in some points, to Fourier's. In the *Mémoires des savans étrangers* for 1835, appears a memoir, which, if it does not absolutely supersede all that had been previously done in assigning the positions of the real roots of equations, yet in simplicity, completeness, and universality of application, surpasses them all. The author, M. Sturm, of French extraction, but born at Geneva, has in his memoir linked his name to a theorem which is likely to retain its place amongst the permanent extensions of the domain of analysis as long as the study of algebra shall last. It was presented to the Academy in 1829.

Determinants.—The solution of simultaneous equations of the first degree may be presented under the form of a set of fractions, the numerators and denominators of which are symmetric products of the coefficients of the unknown quantities in the equations. These products were originally known as *resultants*, a name applied to them by Laplace, and retained as late as 1841 by Cauchy in his *Exercices d'analyse et de physique mathématique*, vol. ii. p. 161, but now replaced by the title *déterminants*, a name first applied to certain forms of them by Gauss. In his *Cours d'analyse algébrique*, Cauchy terms them *alternate* functions. The germ of the theory of determinants is to be found in the writings of Leibnitz, who, indeed, was far-seeing enough to anticipate for it some of the power which, about a century after his time, it began to attain. More than half that period had indeed elapsed before any trace of its existence can be found in the writings of the mathematicians who succeeded Leibnitz. The revival of the method is due to Cramer, who, in a note to his *Analyse des lignes courbes algébriques*, published at Geneva in 1750, gave the rule which establishes the sign of a product as *plus* or *minus*, according as the number of displacements from the typical form has been even or odd. Cramer was followed in the last century by Bézout, Laplace, Lagrange, and Vandermonde. In 1801 appeared the *Disquisitiones Arithmeticae* of Gauss, of which a French translation by M. Poulet-Delisle was

given in 1807. Notwithstanding the somewhat obscure form in which this work was presented, its originality gave a new impetus to investigations on this and kindred subjects. To Gauss is due the establishment of the important theorem, that the product of two determinants both of the second and third orders is a determinant. Binet, Cauchy, and others followed, and applied the results to geometrical problems. In 1826, Jacobi commenced a series of papers on the subject in *Crelle's Journal*. In these papers, which extended over a space of nearly twenty years, the subject was recast and made available for ordinary readers; and at the same time it was enriched by new and important theorems, through which the name of Jacobi is indissolubly associated with this branch of science. Following the steps of Jacobi, a number of mathematicians of no mean power have entered the field. Pre-eminent above all others are two British names, those of Sylvester and Cayley. By their originality, by their fecundity, by their grasp of all the resources of analysis, these two powerful mathematicians have enriched the *Transactions of the Royal Society*, *Crelle's Journal*, the *Cambridge and Dublin Mathematical Journal*, and the *Quarterly Journal of Mathematics*, with papers on this and on kindred branches of science of such value as to have placed their authors at the head of living mathematicians. The reader will find the subject admirably treated in Baltzer's *Theorie und Anwendung der Determinanten*; and more briefly in Salmon's *Higher Algebra*. Elementary treatises have also been published by Spottiswoode in 1851, by Brioschi in 1854, by Todhunter in his *Theory of Equations* in 1861, and by Dodgson in 1867.

The attention of the learned has, during the present century, been called to a branch of the history of algebra, in no small degree interesting; we mean the cultivation of the science to a considerable extent, and at a remote period, in India.

We are indebted, we believe, to Mr. Reuben Burrow for some of the earliest notices which reached Europe on this very curious subject. His eagerness to illustrate the history of the mathematical science led him to collect oriental manuscripts, some of which, in the Persian language, with partial translations, were bequeathed to his friend Mr. Dalby of the Royal Military College, who communicated them to such as took an interest in the subject, about the year 1800.

In the year 1813, Mr. Edward Strachey published in this country a translation from the Persian of the *Bija Ganita* (or *Vija Ganita*), a Hindoo treatise on algebra; and in 1816 Dr. John Taylor published at Bombay a translation of *Lilavati* (or *Lilavati*), from the Sanscrit original. This last is a treatise on arithmetic and geometry, and both are the production of an oriental algebraist, Bhascara Acharya. Lastly, in 1817, there came out a work entitled *Algebra, Arithmetic, and Mensuration, from the Sanscrit of Brahme Gupta and Bhascara*, translated by Henry Thomas Colebrooke, Esq. This contains four different treatises, originally written in Sanscrit verse, viz., the *Vija Ganita* and *Lilavati* of Bhascara Acharya, and the *Ganitad'haya* and *Cuttacad'hyaya* of Brahme Gupta. The first two form the preliminary portion of Bhascara's Course of Astronomy, entitled *Sidd'hanta Siromani*, and the last two are the twelfth and eighteenth chapters of a similar course of astronomy, entitled *Brahma-sidd'hanta*.

The time when Bhascara wrote is fixed with great precision, by his own testimony and other circumstances, to a date that answers to about the year 1150 of the Christian era. The works of Brahme Gupta are extremely rare, and the age in which he lived is less certain. Mr. Davis, an oriental scholar, who first gave the public a correct view of the astronomical computa-

tions of the Hindoos, is of opinion that he lived in the 7th century; and Dr. William Hunter, another diligent inquirer into Indian science, assigns the year 628 of the Christian era as about the time he flourished. From various arguments, Mr. Colebrooke concludes that the age of Brahme Gupta was antecedent to the earliest dawn of the culture of the sciences among the Arabians, so that the Hindoos must have possessed algebra before it was known to that nation.

Brahme Gupta's treatise is not, however, the earliest work known to have been written on this subject. Ganessa, a distinguished astronomer and mathematician, and the most eminent scholiast of Bhascara, quotes a passage from a much older writer, Arya-Bhatta, specifying algebra under the designation of *Vigi*, and making separate mention of *Cuttaca*, a problem subservient to the resolution of indeterminate problems of the first degree. He is understood by another of Bhascara's commentators to be at the head of the older writers. They appear to have been able to resolve quadratic equations by the process of completing the square; and hence Mr. Colebrooke presumes that the treatise of Arya-Bhatta then extant extended to quadratic equations in the determinate analysis, and to indeterminate equations of the first degree, and probably to those of the second.

The exact period when Arya-Bhatta lived cannot be determined with certainty; but Mr. Colebrooke thinks it probable that this earliest of known Hindoo algebraists wrote as far back as the fifth century of the Christian era, and perhaps earlier. He lived therefore nearly as early as the Grecian algebraist Diophantus, who is reckoned to have flourished in the time of the emperor Julian, or about A.D. 360.

Mr. Colebrooke has instituted a comparison between the Indian algebraist and Diophantus, and found reason to conclude that in the whole science the latter is very far behind the former. He says the points in which the Hindoo algebra appears particularly distinguished from the Greek are, besides a better and more convenient algorithm, 1st, the management of equations of more than one unknown quantity; 2^d, the resolution of equations of a higher order, in which, if they achieved little, they had at least the merit of the attempt, and anticipated a modern discovery in the resolution of biquadratics; 3^d, general methods for the resolution of indeterminate problems of the first and second degrees, in which they went far indeed beyond Diophantus, and anticipated discoveries of modern algebraists; and 4th, the application of algebra to astronomical investigations and geometrical demonstration, in which also they hit upon some matters which have been re-invented in modern times.

When we consider that algebra made little or no progress among the Arabians, a most ingenious people, and particularly devoted to the study of the sciences, and that centuries elapsed from its first introduction into Europe until it reached any considerable degree of perfection, we may reasonably conjecture that it may have existed in one shape or other in India long before the time of Arya-Bhatta; indeed, from its close connection with their doctrines of astronomy, it may be supposed to have descended from a very remote period along with that science. Professor Playfair, adopting the opinion of Bailly, the eloquent author of the *Astronomie Indienne*, with great ingenuity attempted to prove, in a *Memoir on the Astronomy of the Brahmins*, that the observations on which the Indian astronomy is founded were of great antiquity, indeed more than 3000 years before the Christian era. The very remote origin of the Indian astronomy had been strongly questioned by many in this country, and also on the Continent; particularly by Laplace, and

by Delambre in his *Histoire de l'Astronomie Ancienne*, tome i. p. 400, &c., and again in *Histoire de l'Astronomie du Moyen Age*, *Discours Préliminaire*, p. 18, &c., where he speaks slightly of their algebra; and in this country, Professor Leslie, in his *Philosophy of Arithmetic*, pp. 225 and 226, calls the *Lilavati* "a very poor performance, containing merely a few scanty precepts couched in obscure memorial verses." We are disposed to agree with Professor Playfair as to the antiquity of this Hindoo algebra. That it should have remained in a state of infancy for so many centuries is accounted for by the latter author in the following passage:—"In India everything [as well as algebra] seems equally insurmountable, and truth and error are equally assured of permanence in the stations they have once occupied. The politics, the laws, the religion, the science, and the manners, seem all nearly the same as at the remotest period to which history extends. Is it because the power which brought about a certain degree of civilization, and advanced science to a certain height, has either ceased to act, or has met with such resistance as it is barely able to overcome? or is it because the discoveries which the Hindoos are in possession of are an inheritance from some more inventive and more ancient people, of whom no memorial remains but some of their attainments 'in science?'"

Writers on Algebra.

Diophantus, "Arithmeticonum Libri sex," about A.D.	360
(First edition of his writings, 1775; the best, 1670.)	
Leonardo Bonacci (his works described in Cassali) .	1202
Lucas Pacioli, or De Burgo, "Summa de Arithmetica, &c."	1494
Rudolff, "Algebra"	1522
Stifelius, "Arithmetica Integra," &c.	1544
Cardan, "Ars Magna quam volgo Cossam vocant" ..	1545
Ferreus	1545
Ferrari (first resolved biquadratic equations) ..	1545
Tartalea, "Questiti ed Inventioni diverse"	1546
Scheubelius, "Algebra Compendiosa"	1551
Recorde, "Whetstone of Wit"	1557
Peletarius, "De Occulta parte Numerorum"	1558
Buteo, "De Logistica"	1559
Ramus, "Arithmeticae Libri duo et totidem Algebrae"	1560
Pedro Nugnez or Nonnius, "Libro de Algebra," &c.	1567
Jossalin, "De Occulta parte Mathematicorum" ..	1576
Bombelli	1579
Clavius	1580
Bernard Solignac, "Arith. Libri ii. et Algebrae totidem"	1580
Stevinus, "Arithmétique, &c. aussi l'Algèbre" ..	1585
Vieta, "Opera Mathematica,"	1600
Folius, "Algebra, sive Liber de Rebus Occultis" ..	1619
Van Ceulen	1619
Bachet, "Diophantus cum Commentariis"	1621
Albert Girard, "Invention Nouvelle en Algèbre" ..	1629
Ghetaldus, "De Resolutione et Compositione Mathematica"	1630
Harriot, "Artis Analyticae Praxis"	1631
Oughtreed, "Clavis Mathematica"	1631
Herigonius, "Cursus Mathematicus"	1634
Cavalieri, "Geometrica Indivisibilibus Continuum, &c."	1635
Descartes, "Geometria"	1637
Franciscus a Schooten, Florimond de Beaune, Erasmus Bertholinus, Joh. Hudde, F. Rabuel, James Bernoulli, John de Witt, &c. — "Commentators on Descartes."	
Roberval, "De Recognitione Aequationum," &c.	1640
De Billy, "Nova Geometricae Clavis Algebrae" ...	1643
Renaldinus, "Opus Algebraicum"	1644
Pascal	1654
Wallis, "Arithmetica Infinitorum," 1655; "Algebra"	1685
Slusius, "Mesolabum"	1659
Rhonijs, "Algebra" (translated into English) ...	1659
Kinckhausen, used as a textbook by Sir I. Newton	1661
Clairaut, "Elémens d'Algèbre"	1746
Maclaurin, "Algebra"	1747
Fontaine, "L'Art de Résoudre les Equations" ...	1747
Donna Maria Gaetana Agnesi, "Istituzioni Analitiche"	1748
Boscovich, in "Elementa Universae Matheseos" ..	1754
Segner, "Berlin Mem"	1756
Castillon, "Arithmetica Universalis Newtoni cum Commentario"	1761
Emerson, "Algebra, &c."	1763
Landen, "Residual Analysis," &c.	1764
Lagrange, "Traité de la Résolution des Equations Numériques, Recueil des Mém. de l'Acad. de Berlin"	1767
Do. republished with Notes, Paris	1797
Euler, "Algebra"	1770
Waring, "Méditationes Algebraicae," &c.	1770, 1776
Soladini, "Compendio d'Analisi"	1775
Paoli, "Elementi d'Algebra"	1794
Ruffini, "Teoria delle Equazione Algeb."	1799
Sir Isaac Newton, "The Binomical Theorem"	1666
Frenicle, Various papers in "Mem. of French Acad."	1666
Pell (translated and improved Rhonijs' Algebra) ..	1668
James Gregory, "Exercitationes Geometricae" ..	1668
Mercator, "Logarithmotechnia"	1668
Barrow, in "Lectiones Geometricae"	1669
Kersey, "Elements of Algebra"	1673
Prescot, "Nouveaux Elémens de Mathématiques" ..	1675
Leibnitz, in "Leipsic Acts," &c.	1677
Fermat, in "Varia Opera Mathematica"	1679
Bulliald, "Opus Novum ad Arithmetica infinitorum"	1682
Tschirnhausen, in the "Leipsic Acts"	1683
Baker, "Geometrical Key," &c.	1684
Dr. Halley, in "Philosophical Transactions" ..	1687
and, ...	1694
Rolle, "Une Méthode pour la Résolution des Equations Indéterminées"	1690
Raphson, "Analysis Aequationum Universalis" ..	1690
Dechaes, "Cursus seu Mundus Mathematicus" ..	1690
Le Lagny, various pieces on Equations	1692
Alexander, "Synopsis Algebraica"	1693
Ward, "Compendium of Algebra," 1695; "Young Mathematician's Guide"	1706
De Moivre, various Memoirs in "Phil. Trans." ..	1697-1730
Sault, "New Treatise of Algebra"	1698
Christopher, "De Constructione Aequationum" ..	1700
Ozanam, "Nouveaux Elémens d'Algèbre"	1702
Harris, "Lexicon Technicum"	1704
Guisnée, "Application de l'Algèbre à la Géométrie"	1705
Jones, "Synopsis Palmarium Matheseos"	1706
Newton, "Arithmetica Universalis"	1707
L'Hôpital, "Traité Analytique des Sections Coniques"	1707
Reyneau, "Analyse Démontrée"	1708
Brooke Taylor, "Methodus Incrementorum" ..	1715
Stirling, "Lineae Tertii Ordinis," 1717; "Methodus Differentialis"	1730
Nicole, On Cubic Equations, in "Mém. Acad. des Sciences"	1717
S'Gravesande, "Algebra"	1727
Wolfius, "Algebra: Cursus Mathematicus"	1732

Kirby, "Arithmetic and Algebra"	1735
James Gregory	1736
Simpson, "Algebra," and various works. . .	1740-1742
Saunderson "Algebra." 2 vols. 4to.	1740
La Caille, "Algebra in Leçons de Mathématiques" 1741	
De Gua, On the Roots of Equations, in "Mém.	
Acad. des Sciences"	1741
Budan, "Nouvelle Méthode pour la Résolution des	
Equations Numériques"	1807
Gompertz "Principles and Application of Imaginary	
Quantities"	1817 and 1818
Biot, "Gergonne's Annales," vol. vi.	
Horner, "Philos. Trans."	1819
Dandelin, "Mém. de l'Acad. Roy. de Bruxelles" . .	1826
Swinburne and Tylecote, "on the Binomial Theorem"	
.	1827
Warren, "on the Geometric Representation of the	
Square Roots of Negative Quantities"	1828
Abel, "Mémoire sur les Equations Algébriques"	
Christiania.	1829
and in "Crelle," vol. i. 4.	
Flourier, "Analyse de Equations Déterminées"	
(posthumous), with preface by Navier.	1831
Malfatti, "Mem. della Soc. Ital.," vol. xi.	
Davis Gilbert, "Philos. Trans."	1831
Sturm, "Mém. présentés par les Savans Etrangers" 1835	
Lockhart, "Resolution of Equations"	1837

To the preceding list of writers, which contains almost all of an early date, the following are to be added:—

Arbogast, "Calcul des Dérivations."	
The Bernoullis, Bégault, Bertrand, Bezout ("Cours des	
Mathématiques"), Bossuet, Burja, Brunacci, Babbage,	
Bridges, Bland, Budan, Bonycastle, Bourdon, Bar-	
low (on the "Theory of Numbers"), Baltzer (on	
"Determinants").	
Cousin, Cauchy, Coignet, Carnot, Cayley, Cockle.	
Degraave, Ditton, Dodgson (on "Determinants").	
Frisius, Francœur, Frend.	
Gauss, "Disquisitiones Arithmetice," 1801.	
Hemischius, Hales, Hirsch, Hutton, Holdred, Horner,	
Hargreaves.	
Kuhnus, Kramp, Kaestner.	
Laloubre, Lorgna, Le Blonde, Lee, Lacroix, Ludlam,	
Legendre (on the "Theory of Numbers"), L'Huilier,	
Leroy.	
Mescher, Melebranche, Manfredi, Maseres, Murphy.	
Nicholson, Nieuwentijdt ("Analysis Infinitorum").	
Polletti, Poignard (on "Magic Squares"), Playfair.	
Rowning, Reimer.	
Suremain-Missery (on "Impossible Quantities"), Schon-	
erus, Salignut, Sturm, Serret, Salmon, Sylvester.	
Trail, Tedenat, Thacker.	
Vilent, Vandermonde.	
Warren, Wells, Wilson, Wood, Woodhouse.	
Young.	
"Elementary Treatises" of Byrce, Colenso, De Morgan,	
Hind, Keiland, Peacock, Todhunter.	

Writers on the History of Algebra.

Wallis, in his "Algebra"; Maseres, "Scriptores Logarithmici, 1791, Montucla, in "Histoire des Mathématiques"; Bossuet, "Histoire des Mathématiques"; Cossali, "Origine, Trasporto in Italia, e Primi Progressi in Essa dell' Algebra," 2 vols. printed in 1797; Hutton, in his "Dictionary," and more diffusely in his "Tracts," vol. ii.; "Libra Histoire des Sciences Mathématiques en Italie," Paris 1838.	
Terquem, "Bulletin de Bibliographie."	
Peacock "Report of British Association," 1833.	
For the titles of works on Algebra, consult Murhard, "Bibliotheca Mathematica;" and for Memoirs on Alge-	

bra, in Academical Collections, see Reuss, "Repertorium Commentationum," tom. vii.; Smith (on the "Theory of Numbers"), Brit. Assoc. 1859-60, 1862-63.

NOTATION AND FIRST PRINCIPLES.

1. In arithmetic there are ten characters, which being variously combined, according to certain rules, serve to denote all numerical magnitudes whatever. But this method of expressing *quantities* (a phrase used to designate something more than mere numbers), is found to be inadequate, taken by itself, to the more difficult cases of mathematical investigation; and it is therefore necessary, in many inquiries concerning the relations of magnitude, to have recourse to that more general mode of notation, and more extensive system of operations, which constitute the science of algebra.

In algebra quantities of every kind may be denoted by any characters whatever, but those commonly used are the letters of the alphabet; and as in the simplest mathematical problems there are certain magnitudes given in order to maintain other magnitudes which are unknown, the first letters of the alphabet, *a, b, c*, &c., are used to denote known quantities, while those to be found are represented by *z, x, y*, &c., the last letters of the alphabet.

2. The sign + (*plus*) denotes, in arithmetic, that the quantity before which it is placed is to be added to some other quantity. Thus, $a+b$ denotes the sum of *a* and *b*; $3+5$ denotes the sum of 3 and 5, or 8.

The sign — (*minus*) signifies that the quantity before which it is placed is to be subtracted. Thus, $a-b$ denotes the excess of *a* above *b*; $6-2$ is the excess of 6 above 2, or 4.

Quantities which have the sign + prefixed to them are called *positive*, and such as have the sign — are called *negative*.

When no sign is prefixed to a quantity, + is always understood, or the quantity is to be considered as positive.

Quantities which have the same sign, either + or —, are said to have like signs. Thus, $+a$ and $+b$ have like signs, but $+a$ and $-c$ have unlike signs.

3. A quantity which consists of one *term* is said to be *simple*; but if it consist of several terms, connected by the signs + or —, it is then said to be compound. Thus, $+a$ and $-c$ are simple quantities; and $b+c$, and $a+b-d$, are compound quantities.

4. To denote the product arising from the multiplication of quantities, they are either joined together, as if intended to form a word, or else they are connected together, with the sign $\times$ or $\cdot$ interposed between every two of them. Thus, ab , or $a \times b$, or $a \cdot b$, denotes the product of *a* and *b*; also abc , or $a \times b \times c$, or $a \cdot b \cdot c$, denotes the product of *a, b*, and *c*. If some of the quantities to be multiplied be compound, each of these has a line drawn over it called a vinculum, and the sign $\times$ is interposed, as before. Thus, $a \times c + d \times e - f$ denotes that *a* is to be considered as one quantity, the sum of *c* and *d* as a second, and the difference between *e* and *f* as a third; and that these three quantities are to be multiplied into one another. Instead of placing a line over such compound quantities as enter a product, we may enclose each of them between two parentheses, so that the last product may be otherwise expressed thus, $a(c+d)(e-f)$; or thus, $a \times (c+d) \times (e-f)$.

A number prefixed to a letter is called a *numerical coefficient*, and denotes how often that quantity is to be taken. Thus $3a$ signifies that *a* is to be taken three times. When no number is prefixed, the coefficient is understood to be unity.

5. The quotient arising from the division of one

quantity by another is often expressed by placing the *dividend* above a line, and the *divisor* below it. Thus,

$\frac{12}{3}$ denotes the quotient arising from the division of 12 by 3, or 4; $\frac{b}{a}$ denotes the quotient arising from the division of b by a .

6. The equality of two quantities is expressed by putting the sign $=$ between them. Thus, $a + b = c - d$ denotes that the sum of a and b is equal to the excess of c above d .

7. Simple quantities, or the terms of compound quantities, are said to be *like*, which consist of the same letter or letters taken together in the same way. Thus, $+ab$ and $-sab$ are like quantities, but $+ab$ and $+abb$ are unlike.

There are some other characters, such as $>$ for *greater than*, $<$ for *less than*, $\therefore$ for *therefore*, which will be explained when we have occasion to use them; and in what follows we shall suppose that the operations and notation of common arithmetic are sufficiently understood.

8. As the science extends itself beyond its original boundaries, it begins gradually to appear that the limits imposed by these definitions have been transgressed, so that almost insensibly the symbols have acquired for themselves significations much more comprehensive than those originally attached to them. Thus, were $+a$ to signify *gain* of £ a , $-a$ would signify *a loss* of the same sum; were $+a$ to signify motion *forwards* through a feet, $-a$ would signify motion *backwards* through the same space. The extended definitions of $+$ and $-$ may now be such as the following: $+$ and $-$ are *collective* symbols of operations the reverse of each other. From similar considerations to those by which the signification of $+$ and $-$ has been extended, we extend that of $\times$ and $\div$ to something like the following: $\times$ and $\div$ are *cumulative* symbols of operations the inverse of each other. We may now exhibit the most general definition of the four symbols in the following form: $+$ and $-$ are symbols of operations prefixed to algebraical symbols of quantity, and are such that $+a - a = +0$ or -0 , where $+0$ means simply or very nearly *increased* by 0; -0 , *diminished* by 0. $\times$ and $\div$ are symbols of operations prefixed to algebraical symbols of quantity, and are such that $\times a \div a = \times 1$ or $\div 1$, where $\times 1$ means simply or very nearly *multiplied* by 1; $\div 1$, *divided* by 1.

9. The laws by which the symbols are combined are the same as arithmetic. It is desirable, however, to exhibit them. They are three,—

LAW I. Quantities affected by the signs $+$ and $-$ are in no way influenced by the quantities to which they are united by these signs.

LAW II. *The Distributive Law*.—Additions and subtractions may be performed in any order.

LAW III. *The Commutative Law*.—Multiplications and divisions may be performed in any order.

We may remark that these laws are *assumed* for algebra, so that the science is limited by their applicability. Algebra has been extended into the science of quaternions by freeing it from part of the limitation imposed by the third of these laws. In this new science ab is not the same thing as ba .

ALGECIRAS, or ALGEZIRAS, a seaport of Spain, in the province of Cadiz, 6 miles W. of Gibraltar, on the opposite side of the bay. The town is picturesquely situated, and its name, which signifies in Arabic the *island*, is derived from a small islet which forms one side of the harbor. It is supplied with water by means of a beautiful aqueduct. It has a dilapidated fortress, and also a military hospital. Population, 14,210.

ALGER OF LIÉGE, known also as ALGER OF CLUGNY and ALGERUS MAGISTER, a learned French priest who lived in the first half of the 12th century.

ALGERIA, or ALGIERS (French, *L'Algérie*), the largest and most important of the French colonial possessions, is a country of Northern Africa, bounded on the N. by the Mediterranean, W. by the state of Morocco, S. by the desert of the Sahara, and E. by Tunis. The boundaries, however, are in many parts not accurately determined. It extends for about 625 miles along the coast and stretches inland from 320 to 380 miles; lying between $2^{\circ} 10'$ W. and $8^{\circ} 50'$ E. long., and 32° and 37° N. lat. The area is estimated at about 184,474 English square miles. Population, (1901), 4,774,042.

The country is generally mountainous, being traversed by lofty ranges of the Atlas system, which run nearly parallel to the coast, and rise in some places to the height of upwards of 7000 feet. These are commonly divided into two leading chains, which are distinguished as the Great and Little Atlas. The former, which is the more southern and bordering on the Sahara, contains some of the highest points in the country. The Little Atlas or Maritime Atlas, as it is sometimes called, lies between the sea and the Great Atlas, and is composed of numerous diversified ranges generally of no great elevation. A number of smaller chains lie between these principal ones, and also between the latter and the sea, forming so many ascending steps or degrees. These principal ranges are connected by numerous transverse ones, thus forming extensive table-lands and elevated valleys, with no connection between them but the intervening heights. Occasionally the principal ranges are broken by deep defiles and narrow valleys.

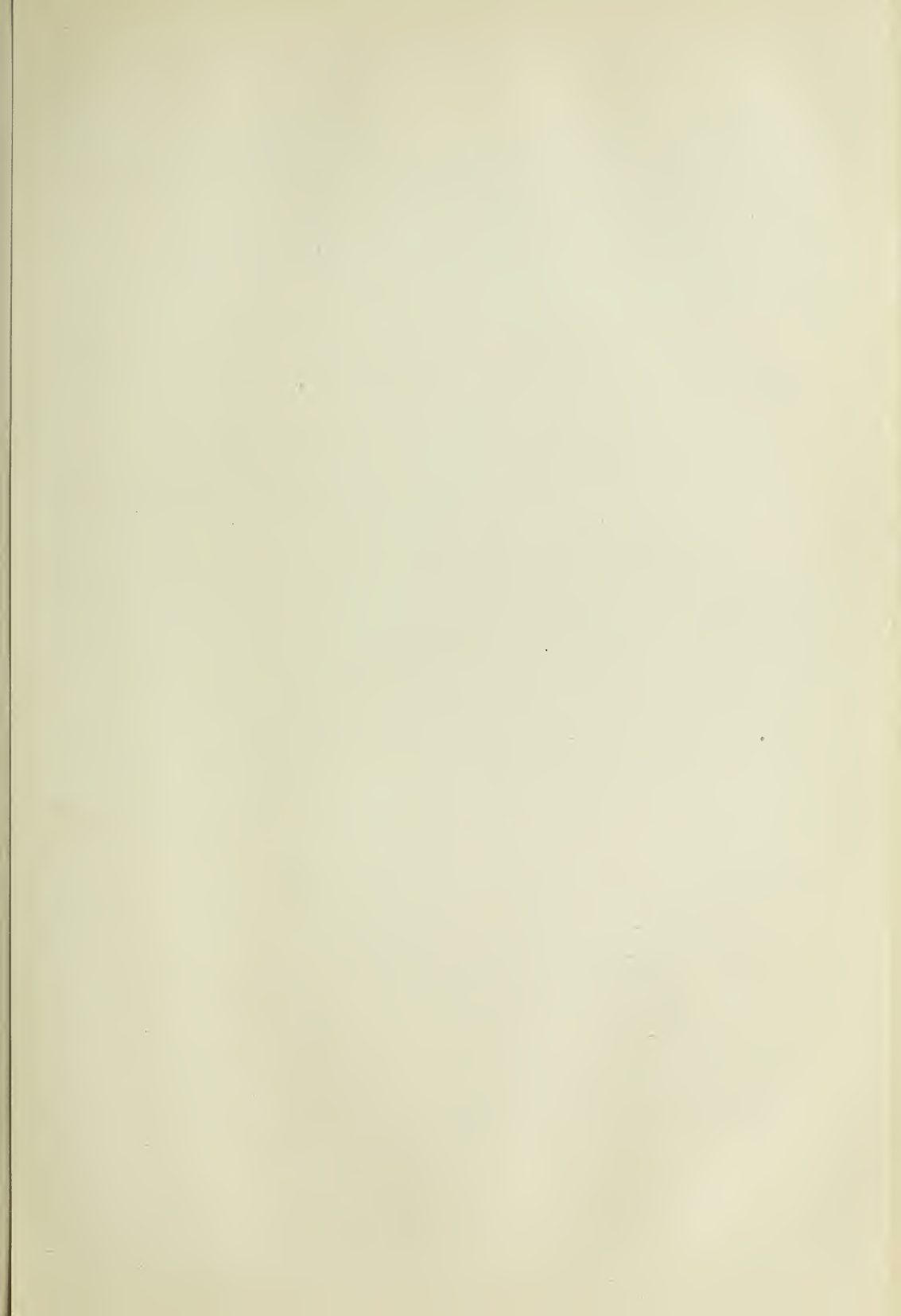
The rivers are numerous, but the majority of them have short courses.

Algeria abounds in extensive lakes and marshes. It is divided by a line running nearly east and west into two distinct zones, called by the natives the *Tell* and *Sahara*.

From its position, Algeria might be supposed to enjoy a warm climate; but the temperature varies considerably in different parts, according to the elevation and configuration of the country. In the northern districts the climate very much resembles that of the south of Spain, while in the Sahara the heat is often excessive. In the more elevated regions the winter is frequently very severe; but along the coast the temperature is mild, very rarely sinking to the freezing-point even in winter, when heavy rains are of frequent occurrence.

Besides the Europeans there are eight distinct races of inhabitants in Algeria—(1.) The Kabyles or Berbers, the descendants of the aboriginal inhabitants of the country, constitute a large portion of the entire population. (2.) The Arabs are a very numerous class, and inhabit principally the southern parts of the country. (3.) The Moors, a mixed race, inhabit the towns and villages chiefly on or near the sea-coast. (4.) The Jews are also to be found in the towns, and are engaged in mercantile pursuits. (5.) The Turks, though long the dominant race, were never very numerous, and since the French conquest they have nearly disappeared. (6.) Kolougis are the descendants of Turks by native women, and constitute a considerable proportion of the inhabitants of Algiers and other towns. (7.) The Negroes were originally brought from the interior and sold as slaves, but slavery now no longer exists. (8.) The Mozabites are an African race, to be found inhabiting the coast towns, and chiefly engaged in manual labor.

When under the dominion of the Turks, this country was governed by a dey, and divided into four provinces—Algiers and Titterie in the centre, Tlemcen in the west, and Constantine in the east. The last





three were governed by beys under the dey. At present it is divided into three provinces—Algiers in the centre, Oran in the west, and Constantine in the east.

In early times this country was inhabited by two nations, the Massyli and Massæsyli. During the struggle between Hannibal and the Romans, Syphax, the prince of the Massæsyli, espoused the cause of the former, and Masinissa, the prince of the Massyli, that of the latter. On the defeat of the Carthaginians the territories of Syphax were annexed to those of Masinissa, who received the title of King of Numidia. During the Roman civil war, Juba, king of Numidia, sided with Pompey, and being defeated by Cæsar, his kingdom became a Roman province. Under the Romans the country enjoyed a great degree of prosperity. Agriculture was encouraged, commerce extended, roads were formed, and towns sprang up. Christianity, too, was early introduced and flourished. This state of things, however, received a severe check when the Romans were driven out of Africa by the vandals about the middle of the 5th century. These in turn were expelled by Belisarius, Justinian's general, in 533. About the middle of the 7th century the Saracens made themselves master of the country, which came afterwards to be divided into a number of petty states under independent chiefs, and the people sank into a state of barbarism. About the middle of the 11th century Abdallah-ben-Yazim, a learned Arab, formed a numerous sect of religionists, known as Morabites, who overran the country, subdued many of the petty chiefs, and laid the foundation of the dynasty of the Almoravides. In 1505, Ferdinand, king of Spain, sent a powerful fleet and army against the country, under the Count of Navarre, who soon made himself master of Oran, Bugia, and other towns, and finally, in 1509, took the town of Algiers. The Spanish rule, however, was very distasteful to the Algerines; and on hearing of the death of Ferdinand, in 1516, one of the native princes sent an embassy to Aruch Barbarossa, the famous Turkish pirate, requesting his aid against the invaders. This was readily granted; and no sooner had he established himself in the country than he murdered the prince and caused himself to be proclaimed king in his room. He introduced that system of piracy for which Algeria was afterwards noted down to 1830. By force and treachery he extended his dominion over other parts of the country, till at length the Spaniards marched a large army against him from Oran, and being joined by many of the natives, defeated him in various engagements, took him prisoner, and beheaded him. His brother Hayradin was then chosen sultan; and he feeling himself unable to cope with the Spaniards, sought the assistance of Turkey, and put himself under the protection of the Grand Seigneur. Aid was readily granted, and he himself was appointed pasha or viceroy of Algiers. Having thus got rid of his enemies, the Spaniards, he turned his attention to the extension of his piratical enterprises; and in order to do this with the greater security, he fortified the port of Algiers and built a strong mole for the protection of his ships. He is said to have employed 30,000 Christian slaves for three years in the construction of the mole. The Algerine pirates soon became dreaded, not only by the Arabs and Moors, but also by the maritime Christian powers, particularly the Spaniards. At length Pope Paul III. induced Charles V. to undertake an expedition to suppress these depredations, and issued a bull offering remission of sins and the crown of martyrdom to all who either fell in battle or were made slaves. The emperor set sail with 120 ships and 20 galleys, having on board 30,000 chosen men. They landed in safety, and were proceeding to attack the town of Al-

giers when a fearful storm arose, and in one night (28th Oct. 1511) destroyed 86 ships and 15 galleys with all their crews and military stores, so that the army on shore was deprived of the means of subsistence. This was then fallen upon by the Algerines, when many were killed and a great number taken prisoners, Charles himself and the remains of his army escaping with difficulty.

Algiers continued to be governed by viceroys or pashas appointed by the Porte till the beginning of the 17th century, when the janissaries solicited and obtained the right to choose their own dey or governor from among themselves. In 1609, the Moors being expelled from Spain, flocked in great numbers to Algiers, and, as many of them were very able sailors, they contributed to raise the power of the Algerine fleet. In 1616 it consisted of forty sail of ships, of between 200 and 400 tons, their flagship having 500 tons. The Algerine pirates now became so formidable to the European powers, that in 1617 the French sent against them a fleet of fifty sail, under Beaulieu, who defeated their fleet and took two of their vessels. In 1620 the English sent out a squadron under the command of Sir Robert Mansel on the same errand, but it returned without effecting anything. Their depredations becoming still more frequent and troublesome, the Venetians equipped a fleet of twenty-eight sail, under the command of Admiral Capello, with orders to burn, sink, or take all the Barbary corsairs he should meet. In an engagement which speedily took place he signally defeated them, and took and destroyed sixteen of their galleys. They soon, however, regained their former strength; and at length Louis XIV., provoked by the outrages committed by them on the coasts of Provence and Languedoc, ordered in 1681, a considerable fleet to be fitted out against them, under the command of Vice-admiral Duquesne. He attacked them near the island of Scios, and destroyed fourteen of their ships. This, however, had little effect upon them, and the following year he bombarded the town of Algiers and nearly reduced it to ashes. The Algerines, by way of reprisal, sent a number of galleys to the coast of Provence, where they committed great ravages. In May 1683, Duquesne with his fleet again cast anchor before Algiers, and proceeded to bombard the town. The dey and the people sued for peace; but Mezomorto, the Algerine admiral, who was to have been delivered up as one of the hostages, violently opposed coming to terms, stirred up the soldiery against the dey, and caused him to be murdered, and was himself chosen as his successor. The bombardment was renewed, and Mezomorto, reduced to extremities, caused all the French in the city to be cruelly murdered, and the French consul to be tied to the mouth of a mortar and shot off in the direction of the bombarding fleet. Duquesne was so exasperated by this piece of cruelty that he did not leave Algiers till he had utterly destroyed the fortifications, shipping, almost all the lower, and about two-thirds of the upper part of the town. The Algerines, now thoroughly humbled, sent an embassy to France to sue for peace, which was readily granted them. In 1686 the English concluded a treaty with the Algerines on favorable terms, and this was several times subsequently renewed; but it was not till the taking of Gibraltar and Port Mahon that England had sufficient check upon them to enforce the observance of treaties. From that time England was treated with greater deference than any other European power. In 1710 the Turkish pasha was expelled and his office united to that of dey. The dey thus became the supreme ruler in the country.

Matters continued very much in the same state, and the history of Algiers presents little calling for special notice down to the expedition of Lord Exmouth. The

principal States of Europe had their attention taken up with weightier matters; but on the establishment of the peace of 1815 the English sent a squadron of ships, under Lord Exmouth, to Algiers, to demand the liberation of all slaves then in bondage there, and the entire discontinuance of piratical depredations. Afraid to refuse, the Algerines returned a conciliatory answer, and released a number of their slaves; but no sooner had the ships left than they redoubled their activity and perpetrated every sort of cruelty against the Christians. Among the other acts of cruelty, they attacked and massacred a number of Neapolitan fishermen who were engaged in the pearl-fishery at Bona. The news of this excited great indignation in England, and Lord Exmouth was again despatched with five ships of the line and eight smaller vessels, and at Gibraltar he was joined by a Dutch fleet of six frigates, under Admiral Capellen. They anchored in front of Algiers on the 26th August 1816. Certain terms, which were extremely moderate, were proposed to the dey; but these not meeting with acceptance, a fierce bombardment was at once commenced. At first the assailants were subjected to a heavy fire from the enemy's batteries; but after a time these were one by one silenced, and ship after ship caught fire, till the destruction of the Algerine naval force was complete. Next day the terms proposed to the dey were accepted; Christian slaves to the number of 1211 were set at liberty, and a promise was given that piracy and Christian slavery should cease for ever. The Algerines, however, did not long adhere to the terms of the treaty. They lost no time in putting their city in a more formidable state of defence than before, and this done, they considered themselves in a condition to set the great powers of Europe at defiance.

Various injuries had from time to time been inflicted on the French shipping, but that which more directly led to a declaration of war was an insult offered to the French consul by the dey. A debt had been contracted by the French government to two Jewish merchants of Algiers at the time of the expedition to Egypt, and the dey having a direct interest in the matter, had made repeated applications for payment, but without success. Annoyed at this and at what he considered insulting language on the part of the consul, he struck the latter on the face in public. In consequence of this, a French squadron was sent to Algiers which took the consul on board, and for three years maintained an ineffective blockade. At length war on a great scale was resolved on, and a fleet was equipped at Toulon in May 1830 under the command of Admiral Duperré. It had also on board a land force, under the command of General Bourmont, consisting of 37,000 infantry, 4000 cavalry, and a proportionate number of artillery. The troops began to land on the 14th June upon the western side of the peninsula of Sidi Ferruch, in the bay of Torre Chica. They did not meet with much opposition till the 19th, when a general attack was made upon them by a force of 40,000 to 50,000 men. These, after a fierce conflict, were completely routed. They renewed their attack on the 24th and 25th, but were on both occasions repulsed. The French then advanced upon Algiers, and on the 29th the trenches were opened. On the morning of the 4th of July the bombardment commenced, and before night a treaty was concluded for the entire surrender of Algiers. The next day the French took possession of the town; and 12 ships of war, 1500 brass cannon, and over £2,000,000 sterling came into their hands as conquerors. The Turkish troops were permitted to go wherever they pleased, provided they left Algiers, and most of them were conveyed to Asia Minor. They dey himself, with his

private property and a large body of attendance, retired to Naples.

In February 1831 General Berthezene was appointed commander-in-chief, and undertook several expeditions into the interior to chastise the hostile tribes, but met with little success. In October Bona was surrounded and taken by the Kabyles. There was now no safety but in the town of Algiers; agriculture was consequently neglected, and it was necessary to send to France for supplies of provisions and for fresh troops. In November 1831 General Savary, Duc de Rovigo, was sent out with an additional force of 16,000 men. The new governor sought to accomplish his ends by the grossest acts of cruelty and treachery. One of his exploits was the massacre of a whole Arab tribe, including old men, women, and children, during night, on account of a robbery committed by some of them. He also treacherously murdered two Arab chiefs whom he had enticed into his power by a written assurance of safety. These proceedings exasperated the natives still further against the French, and those tribes that had hitherto remained quiet took up arms against them.

About this time Abd-el-Kader first appears upon the field. His father, a Marabout, had collected a few followers, and attacked and taken possession of the town of Oran. On this they wished to elect him as their chief, but he declined the honor on account of his great age; and recommended his son who, he said, was endowed with all the qualities necessary to success. He collected an army of 10,000 horsemen, and, accompanied by his father, marched to attack Oran, which had been taken possession of by the French. They arrived before the town about the middle of May 1832, but after continuing their attack for three days with great bravery they were repulsed with considerable loss. Abd-el-Kader was still extending his influence more and more widely among the Arab tribes; and the French at last considered it to be to their interest to offer him terms of peace. A treaty was accordingly concluded with him by General Desmichels, governor of Oran, in February 1834, in which he acknowledged the supremacy of France, and was recognised by them as emir of the province of Mascara. One of the conditions of the treaty was that the emir was to have a monopoly of the trade with the French in corn. This part of the treaty was regarded with great dissatisfaction at home, and the general was removed from his post. In July General Drouet d'Erlon was sent out as governor-general of the colony. An intendant or head of the civil department was also appointed, as well as a commissary of justice at the head of the judicature. Tribunals of justice were also established, by which both French and natives were allowed to enjoy their respective laws. From the tranquil state of the country at this time the new governor was enabled to devote his attention to its improvement. The French, however, soon became jealous of the power of the emir, and on the pretence that he had been encroaching on their territory, General Trezel, who had succeeded Desmichels in the governorship of Oran, was sent against him with a considerable force. The armies met at the river Makta, and the French were routed with great slaughter on the 28th of June 1835. On the news of this defeat Marshal Clausel was sent to Algiers to succeed Count d'Erlon. In order effectually to humble the emir, he set out for his capital, Mascara, accompanied by the Duke of Orleans, at the head of 11,000 men. On reaching the town the French found it deserted, and, having set it on fire, they returned without having effected anything of consequence.

General Bugeaud, who had succeeded Marshal Clausel, attacked the Arabs under Abd-el-Kader on the Sikak

river, 6th July 1836, and gained a complete victory over them. An expedition against the bey of Constantine was next resolved upon, and Marshal Clausel, at the head of 8000 men, set out from Bona for this purpose in November 1836. They encountered on their march a severe storm of hail and snow, followed by a sharp frost, so that many of them died; and when they arrived before the walls of the town they were unable to undertake the siege, and effected their retreat with difficulty. The French were now anxious to conclude a peace with Abd-el-Kader, and with this view General Bugeaud arranged a meeting with him on the banks of the Tafna, and a treaty was signed, 30th May 1837. They were then free to turn their strength against the bey of Constantine, and an army of 20,000 men set out from Bona with this object under the command of General Damrémont early in October. The town was, after a very gallant defence, taken by storm on the 12th of that month by General Valée, General Damrémont having been killed by a cannon ball the previous day. On the capture of the city the neighboring tribes hastened to make their submission to the conquerors, and a strong garrison being left to defend the town, the army returned to Bona. Disputes with the emir as to the boundaries of his territory were frequent, and at length war was again declared between the parties. The immediate cause of war on this occasion was the marching of an armed force of French troops through the emir's territory. This the latter looked upon as an infringement of the treaty, and consequently declared war. In October 1839, he suddenly fell upon the French troops in the plain of Metidja, and routed them with great slaughter, destroying them and laying waste the European settlements. He surprised and cut to pieces bodies of troops on their march; outposts and encampments were taken by sudden assault; and at length the possessions of the French were reduced to the fortified places which they occupied. On the news of these events reaching France, reinforcements to the amount of 20,000 men were sent out. The fort of Masagan, near Mostaganem, with a garrison of only 123 men, gallantly withstood a fierce attack by 12,000 to 15,000 Arabs, which lasted for three days. Marshal Valée was now recalled, and General Bugeaud appointed to succeed him. The latter arrived at Algiers on the 22d of February 1841, and adopted a new system, which was completely successful. He made use of movable columns radiating from Algiers, Oran, and Constantine, and having from 80,000 to 100,000 troops at his disposal, the result soon told against the emir. Many of the Arab tribes were thus intimidated or brought under subjection, hard pressed garrisons were relieved and victualled, and town after town taken. Tekedemt, the principal stronghold of Abd-el-Kader, was destroyed, and the citadel blown up; Mascara was taken; and Saïda, the only remaining fortress in the possession of the emir, was entirely demolished. In January 1842 the town of Tlemcen was taken, and ten days afterwards the fort of Tafna, which was demolished. The terrified Arabs submitted on all sides, and now almost the entire country was subdued. The emir himself, driven to extremities, was compelled to take refuge in Morocco. Here he succeeded in raising a considerable force, and returned to Algeria. He made up for the want of troops by the rapidity of his movements, and would suddenly make an attack on one place when he was supposed to be in quite an opposite quarter. In November 1842 the Duke of Aumale arrived in Algiers to take part in the operations against the emir; and in the spring of the following year he suddenly fell upon the camp of Abd-el-Kader while the great body of his troops were absent, and took several thousand prisoners and a large booty, the emir himself

making his escape with difficulty. Not long afterwards the latter again took refuge in Morocco, and so excited the fanatical passions of the people of that country that their ruler was forced into a war with France. The army which was sent into Algeria was attacked and defeated by Bugeaud at the river Isly, 14th August 1844. In June 1845 a tribe of Arabs, who were being pursued by a body of French troops under General Pellissier, took refuge in a cave. As they refused to surrender, the general ordered a fire to be kindled at the mouth of the cave, and the whole of those within, men, women, and children, to the number of 500, were suffocated. The emir at length was brought to such straits that he agreed to deliver himself up to the French on being allowed to retire to Alexandria or St. Jean d'Acre. Notwithstanding this promise, which was given by General Lamoricière, and ratified by the governor-general, he was taken to France, where he arrived on the 29th of January 1848; and was imprisoned first in the castle of Pau, and afterwards in that of Amboise, near Blois. In October 1852 Louis Napoleon, then president of the French Republic, gave him his liberty on condition that he should not return to Algeria, but reside at Broussou in Asia Minor. Here he remained till 1855 when, in consequence of the destruction of that town by an earthquake, he obtained permission to remove to Constantinople, and afterwards to Damascus. At the latter place he rendered valuable aid to the Christians by protecting them during the massacre by the Turks in Syria in 1860.

On the revolution in France of 1848, General Cavaignac was appointed governor-general of the colony; and the National Assembly, wishing to establish a closer connection between the country and France, offered to incorporate it with the republic.

In 1858 the administration of the colony was confided to a special minister, the first nominated being Prince Napoleon; but he only held office for a short time; and soon after, the special ministry was abolished. In October 1859 certain Arab tribes rose in rebellion, but were speedily subdued. In 1860 Marshal Pellissier was made governor-general, with a vice-governor, a director-general of civil affairs, and a council of thirty members. Marshal Pellissier died in May, and Marshal M'Mahon was appointed to succeed him. A fresh insurrection of the Arabs broke out in October, but after several defeats they were brought to subjection. In May 1865 the Emperor Napoleon visited Algeria, and was everywhere received with the greatest demonstrations of joy. After his return to France he wrote a letter to Marshal M'Mahon respecting the future government of the colony. He particularly pointed out the necessity of seeking to gain the good-will of the natives by permitting them to enjoy their territories unmolested, and to maintain their own customs, and that they should be held as equal with the colonists before the law. He further directed him to seek to stimulate the industry of the colonists, and to strive to develop the resources of the country. In October a fresh insurrection broke out in the province of Oran. It commenced with an attack upon a friendly tribe, but was at length put down by a body of troops under the command of Colonel de Colomb. It again broke out in March 1866, and Colonel de Colomb was a second time sent out against the insurgents. He encountered them on the 16th, and, after a fierce engagement, put them to flight with great loss. In the beginning of 1867 a new expedition was organized against the refractory Arabs in the south, and these being effectually put down, a period of comparative peace followed.

In January 1868 a fresh revolt broke out among the Arabs, instigated by Si-Hamed, who had led in more than one of the previous revolts. They assailed and

plundered some of the friendly tribes, and being pursued and attacked by a body of French troops, a fierce engagement took place, in which Si-Hamed was killed and his followers put to flight. Peace was enjoyed for the rest of that year; but towards the end of January 1869 several large bands of insurgent Arabs in the extreme south marched northward, took by surprise Tagguin, and being joined by others, in a short time they numbered 3000 horse. A body of French troops was sent out against them from Laghouat, under the command of Colonel Sonis, and after two and a half hours' hard fighting the insurgents were put to flight with great slaughter. In 1871 a widespread insurrection of Arab and Kabyle tribes broke out, stimulated no doubt by a knowledge of the weakened condition of France at home. It commenced with El-Mokrani, the hereditary bach-agma of the Medjana, attacking and burning the village of Brody-Bon-Arrededy, destroying isolated houses and posts throughout the district subject to his influence, the colonists who did not succeed in reaching a place of safety being massacred. All his attacks against the fortified places, however, failed; and as soon as the French were able to assume the offensive he was beaten in every engagement, and subsequently killed in action. When this rebellion appeared almost overcome, the whole of Kabylia rose in arms at the command of the sheikh El-Haddad, one of the most powerful chiefs in Kabylia, and head of an influential religious confraternity. The Kabyles, for the first time in history, descended from their mountain fastnesses, and attempted to invade the plains of the Metidja. The most horrible massacres were perpetrated, and all the principal ports on the coast were strictly blockaded on the landward side. It was not until after the fall of the commune in Paris that troops could be spared in sufficient numbers to suppress the insurrection. But this was at length effected, and a war contribution of \$6,000,000 imposed upon the rebels, whose lands were also sequestered, but the owners were permitted to resume possession on comparatively easy terms. The greater part of the sum recovered was distributed among the colonists who had suffered during the insurrection, and a considerable portion of it has been allotted for public works. The sequestration has also opened up much valuable territory for European colonisation. Since the insurrection many new colonists have arrived here, and among them many from Alsace and Lorraine. A law passed by the French Chamber, 15th September 1871, authorises, on certain conditions, the gratuitous concession of 247,000 acres of land to such natives of Alsace and Lorraine as might desire to preserve their French nationality. A more favorable era, it is believed, has now dawned for the colony. Down to 1871 it had continued under military rule, and this, it was thought, had had not a little to do with the frequent insurrections that had broken out in the country.

ALGHERO, a seaport of Italy, in the province of Sassari, Sardinia, situated on the west coast of the island, 14 miles S.W. of Sassari. It was founded by the Genoese, and was afterwards taken by the Catalonians. Population about 12,000.

ALGIERS (Fr. *Alger*, Arab. *Al-Jezair*, i.e., The Islands), a city and seaport of Northern Africa, and capital of Algeria, is situated on the west side of a bay of the same name in the Mediterranean. It is built, in the form of an amphitheatre, on the northern slope of a steep hill rising abruptly from the coast. It ascends the side of the hill in the form of an irregular triangle, the apex of which is occupied by the Casbah, an ancient fortress of the deys, which is about 500 feet above the level of the sea. Algiers has of late come to be noted

as a winter residence for invalids. The French have spent large sums of money in the improvement of the port of Algiers. It has an area of 220 acres, and it is calculated that when a rock near the centre, called *Roche Sans Nom*, is removed, it will be capable of accommodating 40 vessels of war and 300 trading vessels. It has two docks, capable of containing the largest vessels. The lighthouse has a revolving light visible at a distance of fifteen miles. Population (1900), 96,784. (For the trade and climate of Algiers, see ALGERIA.)

ALGOA BAY, an inlet in Cape Colony, on the S.E. coast of Africa, 425 miles east from the Cape of Good Hope. Algoa Bay lies between capes Recife and Padrone, on the former of which there is a lighthouse. It receives the rivers Sunday and Baasher.

ALHAMA, a city of Spain, in the province of Granada, 24 miles S.W. of Granada. Alhama was a most important fortress while the Moors ruled in Granada, and its capture by the Marquis of Cadiz in 1482 was the most decisive step in the reduction of their power. Remains of the Moorish castle and walls are still to be seen, as well as an aqueduct of Roman or Moorish origin. Population about 10,000.

ALHAMA, a town in Spain, in the province of Murcia. Population, 6,860.

ALHAMBRA, the ancient fortress and residence of the Moorish monarchs of Granada, on the north. The name, signifying in Arabic "the red," is derived from the color of the sun-dried *tapia*, or bricks made of fine gravel and clay, of which the outer walls are built. This famous Moorish palace was erected at various dates, chiefly between 1248 and 1354, under the reigns of Ibn-al-Ahmar and his successors. The splendid decorations, and in particular the exquisite painting of the interior, are ascribed to Yusuf I., who died in 1354. Immediately after the expulsion of the Moors in 1492, their conquerors began, by innumerable acts of vandalism, to spoil the marvellous beauty of the Alhambra. The open work was filled up with whitewash, the painting and gilding effaced, the furniture soiled, torn, or removed. Charles V. rebuilt portions in the modern style of the period, and destroyed the greater part of the Winter Palace to make room for a modern structure which has never been completed. Philip V. Italianised the rooms, and completed the degradation by running up partitions which blocked up whole apartments, gems of taste and patient ingenuity. In subsequent centuries the carelessness of the Spanish authorities permitted this pearl of Moorish art to be still further defaced; and in 1812 some of the towers were blown up by the French under Sebastiani, while the whole buildings narrowly escaped the same fate. In 1821 the ancient pile was shattered by an earthquake. Directions were given in 1862, by Isabella, then queen of Spain, for the restoration of the Alhambra to its original condition. The work has been carried on with considerable skill, but the sums devoted to it have been too small for its satisfactory accomplishment.

In the hey-day of Moorish prosperity the palace must have been the most delicious of royal residences. Odoriferous gardens, in which the orange and the myrtle bloomed, alternated with sparkling fountains and soft couches, inviting to a luxurious repose. Everything contributed to render the whole the most splendid abode of Oriental magnificence, to which only the fantastic creations of the *Arabian Nights* can be fitly compared.

The present entrance is by a small insignificant door, from which a corridor conducts to the *Patio de la Berkah*, the Court of the Blessing. This court is 140 feet long by 74 broad; and in the centre there is a large pond set in the marble pavement, full of gold-fish, from

which some have called this the Court of the Pond. It is also known as the Court of the Myrtles, from the myrtles which grow along its sides. There are galleries on the north and south sides; that on the south 27 feet high, and supported by a marble colonnade. Underneath it, to the right, was the principal entrance, and over it are three elegant windows with arches and miniature pillars. The columns supporting the galleries are light in structure, and arches, slender and bending gracefully like palms, spring from the capitals and meet overhead. From this court the walls of the *Torre de Comares* are seen rising over the roof to the north, and its tower and colonnades are reflected in the crystal mirror of the pond.

The Hall of Ambassadors (*Sala de Ambajadores*) is the largest in the Alhambra, and occupies all the Tower of Comares. It is a square room, the sides being 37 feet in length, while the center of the dome is 75 feet high. This was the grand reception-room, and the throne of the sultan was placed opposite the entrance.

Another of the more celebrated courts of the palace is the *Patio de los Leones*, the Court of the Lions. This is an oblong court, 116 feet in length by 66 in breadth, surrounded by a low gallery supported on 124 white marble columns. A pavilion projects into the court at each extremity, with filigree walls and light-domed roof, elaborately ornamented. The square is paved with colored tiles, and the colonnade with white marble; while the walls are covered 5 feet up from the ground with blue and yellow tiles, with a border above and below enamelled blue and gold.

The Hall of the Abencerrages derives its name from a legend according to which Boabdil, the last king of Granada, having invited the chiefs of that illustrious line to a banquet, massacred them here.

Among the other wonders of the Alhambra are the Hall of Justice; the mosque; the *Mirador de Lindaraja*, or boudoir of the sultana; the *Patia de la Reja*; the *Tocador de la Reina*, or queen's boudoir; and the *Sala de los Banos*, in all which are to be seen the same delicate and beautiful architecture, the same costly and elegant decorations. There must also be noticed the celebrated vase of the Alhambra, a splendid specimen of Moorish ceramic art, dating from 1320, and belonging to the first period of Moorish porcelain. It is 4 feet 3 inches high; the ground is white, and the enamelling is in blue, white, and gold. A new hall, called the Hall of the Shields or Escutcheons, has recently been discovered; and the palace contains, besides the more important halls already mentioned, ranges of bed-rooms and summer-rooms, a whispering gallery and labyrinth, and vaulted sepulchres.

In September, 1890, a disastrous fire occurred in the palace, and before it could be checked a large portion of the historic structure lay in ruins. The Court of Lions and the Hall of Justice were both badly damaged, and the injury thus done is incalculable and irreparable. The fire was, it is thought, of incendiary origin, the enemies of the government being suspected.

ALHAZEN (full name, **ABU ALI AL-HASAN IBN ALHASAN**), a mathematician of the 11th century, was born at Bassora, and died at Cairo, in 1038. He is to be distinguished from another Alhazen who translated Ptolemy's *Almagest* in the 10th century. Alhazen having boasted that he could construct a machine for regulating the inundations of the Nile, was summoned to Egypt by the caliph Hakem; but, aware of the impracticability of his scheme, and fearing the caliph's anger, he feigned madness until Hakem's death in 1021. As a writer, Alhazen is remarkable for prolixity and scholastic subtlety. Only two of his works have been printed.

ALI, the fourth in order of the caliphs or successors of Mahomet, was born at Mecca, about the year 600 A. D. His father, Abu Taleb, was an uncle of the prophet, and Ali himself was adopted by Mahomet and educated under his care. While he was still a mere boy he distinguished himself by being the first to declare his adhesion to the cause of Mahomet, who in return made him his vicegerent, and some years after gave him his daughter Fatima in marriage. Ali proved himself to be a brave and faithful soldier; and when Mahomet died without male issue, he seemed to have the best claims to become the recognized head of Islamism. Almost the first act of his reign was the suppression of a rebellion under Telha and Zobeir, who were instigated by Ayesha, the widow of Mahomet, a bitter enemy of Ali, and hitherto one of the chief hindrances to his advancement to the caliphate. The rebel army was defeated at Kharibah, near Bassorah, the two generals being killed, and Ayesha taken prisoner. Ali's next care was to get rid of the opposition of Moawyah, who had established himself in Syria at the head of a numerous army. Ali was not destined to see the result of his plans. Three of the fanatic sect of the Karigites made an agreement to assassinate Ali, Moawyah and Amru as the authors of disastrous feuds among the faithful. The only victim of this plot was Ali, who died at Kufa in 661, of the wound inflicted by a poisoned weapon. The question of Ali's right to succeed to the caliphate is an article of faith which divided the Mahometan world into two great sects, the Sunnis and the Shiahs, the former denying and the latter affirming his right. The Turks, consequently, who are usually Sunnis, hold his memory in abhorrence; whereas the Persians, who are generally Shiahs, venerate him as second only to the prophet, and celebrate the anniversary of his martyrdom.

ALI BEY (1728-73), an adventurer, said to have been a native of the Caucasus, and to have been sold about the age of twelve or fourteen for a slave in Cairo. The two Jews who became his masters presented him to Ibrahim, then one of the most influential men in the kingdom. In the family of Ibrahim he received the rudiments of a literary education, and was also instructed in the military art. He gradually gained the affection of his patron to such a degree that he gave him his freedom, permitted him to marry, and promoted him to the rank of governor of a district. Afterwards he was elected to the elevated station of one of the governors of provinces. Emboldened by success, he rescued himself from the power of the Porte, coined money in his own name, and assumed the rank of sultan of Egypt.

ALI PASHA, surnamed *Arslan* or "The Lion," was born at Tepelini, a village of Albania, on the Voutza, at the foot of the Klissoura Mountains, in 1741. He belonged to the Toske tribe, and his ancestors had for some years held the title of Bey of Tepelini, this dignity having become hereditary in his family. His grandfather fell in 1716 at the siege of Corfu, which was then held by the Venetians. When the French took Venice in 1797, Ali, by pretending admiration for the principles of the revolution, induced Napoleon to send him engineers, by whose aid he fortified Joannina; but failing to obtain from him, as he had hoped, the Venetian ports on the seaboard of Epirus, he took occasion, after the defeat of Napoleon in Egypt, to lay siege to Prevesa, which was surrendered by the French troops. Ali had now a difficult part to play, but he succeeded so well with his master the Sultan, that he was confirmed in the possession of the whole of Albania, northwards from Epirus to Montenegro, over which he had asserted his authority, partly by intrigue and partly by force of arms. He also held the high position of governor of

Rum-ili for a brief period (1799), during which he amassed a large sum of money by his extortions. The cruel massacre of the inhabitants of Gardiki, for an alleged insult to his mother and sister about forty years previously, was perpetrated about this time. He contrived to make his peace with the French in spite of the capture of Prevesa, and in 1807 once more entered into alliance with them, with the view of obtaining Parga, which he had attempted to capture, but without success, in 1800. Napoleon, however, neglected to secure Parga for him at the peace of Tilsit, and the fortress remained in the hands of the French until it was taken in 1814 by the English, who gave it up in 1817, ostensibly to the sultan, but in reality to Ali. Ali was now in the height of his power; he was almost supreme over Albania, Epirus, part of Thessaly, and the western part of Northern Greece; while one of his sons held the pashalik of the Morea. So powerful was he that, though he was nearly eighty years of age, the Porte feared and hated him, and desired his death, but could find no pretext for taking measures against him until 1820, when Ali procured the assassination of an officer who had left him and taken service under the sultan at Constantinople. For this daring act the sultan proscribed Ali, and ordered all the European pashas to march against him. He resisted every effort to capture him, but was at last induced by Kourschid Pasha to surrender in January 1822 on promise of pardon from the sultan. On 5th February, on pretence of handing him the necessary document, Kourschid Pasha procured an interview with him, and then produced the firman authorising his execution. The brave old despot defended himself with his usual resolution and courage, but was overpowered by numbers, and his head was struck from his body and sent to Constantinople.

ALIAS, signifying *at another time*, is used in judicial proceedings to connect the several names of a person who attempts to conceal his true name, or to pass under a feigned one; as Smith alias Jones, James alias John.

ALIBI, in *Law*, denotes the absence of the accused from the place where he is charged with having committed a crime; or his being *elsewhere*, as the word imports, at the time specified.

ALICANTE, a province of Spain, bounded on the N. by Valencia, on the W. by Albacete and Murcia, on the S. by Murcia, and on the S.E. and E. by the Mediterranean Sea. It was formed in 1834 of districts taken from the ancient provinces of Valencia and Murcia, the former contributing by far the larger portion. Its length is about 73 miles, its breadth 68 miles, and the area 2,098 square miles. The surface of the province is extremely diversified. In the north and west there are extensive mountain ranges of calcareous formation, intersected by deep ravines; while farther south the land is more level, and there are many fertile valleys. On the Mediterranean coast, salt marshes, exhaling an insalubrious miasma, alternate with rich plains and pleasant and productive huertas or gardens, such as those of Alicante and Denia. The people are of a lively and irascible temperament, and offences against the person are frequent. Population (1897) estimated at 451,174.

ALICANTE, the capital of the above province, and, after Cadiz and Barcelona, the most considerable seaport of Spain. It is situated at the head of the bay of Alicante, in the Mediterranean Sea. The city is built on the bay in the form of a half-moon, and is overlooked by a rock 400 feet high, surmounted by a castle, which has been suffered to fall into decay. There is good anchoring-ground in the bay, but only the smaller vessels can come up to the mole or pier. Alicante was besieged by the Moors in 1331 and again by the French

in 1709, when the English commandant and his staff were killed by the explosion of a mine. Population (1897), 49,463.

ALICATA, or LICATA, a seaport of Italy, in the province of Girgenti, Sicily, situated on the south coast, at the mouth of the Salso, the largest river in the island. It is supposed to occupy the site of the ancient *Phintias*, built by Phintias, tyrant of Agrigentum, in 280 B. C., after the destruction of Gela. Pop., 2,000

ALICUDI, one of the Lipari Islands. See LIPARI ISLANDS.

ALIEN, obviously derived from the Latin *alienus*, is the technical term applied by British constitutional law to any one who does not enjoy the privileges of a British subject. The jealousy which has generally existed against communicating the privileges of citizenship to foreigners has its foundation in mistaken views of political economy. It arose from the impression that the produce of the energy and enterprise of any community is a limited quantity, of which one man's share will be the less the more competitors there are; superseding the just view that the wealth of a state depends on the number and energy of the producers. Thus the skilled workmen who would increase its riches have often been jealously kept out of a country. But, on the other hand, special temptations, including the gift of citizenship, have often been offered to skilled foreigners by states desiring to acquire them as citizens. Britain has occasionally received industrious and valuable citizens, driven forth by the folly or tyranny of other powers, as in the memorable instance of the revocation of the edict of Nantes, which sent the Spitalfields colony and many other Frenchmen to that country.

Many of the special disabilities to which aliens were subject under the Navigation Act and other laws connected with the old restrictive commercial policy, have been removed or neutralized by the free trade measure of later years; but it is still impossible for an alien to be the owner of a British ship. In other respects the tendency has been to communicate some of the rights of citizenship to aliens, and to widen the definition of subjects.

In the United States an alien desiring to be naturalised must declare on oath his intention to become a citizen of the United States; two years afterwards must declare on oath his intention to support the constitution of the United States; and renounce allegiance to every foreign power, including that of which he was before a subject; must prove residence in the United States for five years, and in the state where his application is made for one year, as a good citizen; and must renounce any title of nobility. In France an alien desiring naturalisation must obtain permission to establish his domicile in France; three years after (in special cases one year) he is entitled to apply for naturalisation, which involves the renunciation of any existing allegiance. (See further, ALLEGIANCE; LAW OF NATIONS.)

ALÍGARH, a district of British India, in the Meerut division, and under the jurisdiction of the Lieutenant Governor of the North-West Provinces. It contains an area of 1954 square miles, of which upwards of two-thirds, or 884,060 acres, are under cultivation. Population in 1865 returned at 925,538 souls, and by a recent census ascertained to be 1,110,000. Aligarh is bounded on the N. by the Bulandshahr district and a portion of Budáon; on the E. by Etah district; on the S. by Mathurá district; and on the W. by Gurgáon and Mathurá districts. Pop. of town (1901), 70,127.

ALÍGARH FORT, in the district of the same name.

ALIMENT, in the *Law of Scotland*, is the sum paid or allowance given in respect of the reciprocal

obligation of parents and children, husband and wife, grandparents and grandchildren, to contribute to each other's maintenance.

ALIMENTARY CANAL is the name given to the principal part of the digestive apparatus. It extends from the mouth to the anus, having, in man, an average length of about thirty feet; *i.e.* five or six times as long as the body. Passing through the head and chest it includes the *teeth*, the organs of mastication; the *salivary glands*, the organs of insalivation; the *tongue*, *pharynx*, *oesophagus* or gullet, the organs of deglutition. In the abdomen and pelvis there are the *stomach* and the *large and small intestine*. See DIGESTION.

ALIMONY is, in law, the allowance for maintenance to which a wife is entitled out of her husband's estate on a decree, obtained at the wife's instance, for judicial separation or for the dissolution of the marriage.

ALISON, REV. ARCHIBALD, an author of great reputation in his own day, was born on the 13th November 1757 at Edinburgh, of which his father was for a time lord provost. His last years were spent at Colinton, near Edinburgh, where he died on the 17th May 1839.

ALISON, SIR ARCHIBALD, Bart., the celebrated historian, younger son of the preceding, was born at Kenley, Shropshire, on the 29th December 1792. He studied at the university of Edinburgh, distinguished himself especially in the classes of Greek and mathematics. In 1814 he passed at the Scotch bar, but he did not at once enter on the regular practice of his profession. The close of the war had opened up the Continent, and Alison, sharing with many of his countrymen the desire to witness the scene of the stirring events of the previous twenty years, set out in the autumn of 1814 for a lengthened tour in France. It was during this period, as he tells us in a characteristic passage of the work itself, that he "conceived the first idea" of writing his History, and "inhaled that ardent spirit, that deep enthusiasm," which enabled him to accomplish his self-imposed task. A more immediate result of the tour was his first literary work of any importance, *Travels in France during the Years 1814-15*, which appeared in the latter year. The history of the period from the commencement of the French revolution till the restoration of the Bourbons in 1815 was completed in ten volumes in 1842, and met with a success almost unexampled in works of its class. Within a few years it ran through ten editions, and was translated into most of the languages of Europe, as well as into Arabic and Hindustani. At the time of the author's death it was stated that 108,000 volumes of the library edition and 439,000 volumes of the popular edition had been sold. Its descriptions of what may be called external history—of battles, sieges, and state pageants—were always spirited and interesting. On the other hand, the faults of the work were so numerous and glaring as to prevent it from ever taking rank as a classic. The general style was prolix, involved, and vicious; inaccurate statements and fallacious arguments were to be found in almost every page; and the constant repetition of trite moral reflections and egotistical references seriously detracted from its dignity. A more grave defect resulted from the author's strong political partisanship, which entirely unfitted him for dealing with the problems of history in a philosophical spirit. In the position of unbending Toryism which he occupied, it was impossible for him to give any explanation of so complex a fact as the French revolution that would be satisfactory to reflective minds. Accordingly, his treatment of what may be called the inner history of those forces hidden in the French revolution which have made modern Europe what it is, was meager and incomplete in the last degree.

A continuation of the history, embracing the period from 1815 to 1852, which was completed in four volumes in 1856, did not meet with the same success as the earlier work. Sir Archibald died at Possil House, Glasgow, on the 23d May 1867.

ALIZARIN, the principal coloring matter of madder, may be obtained by subliming on paper an alcoholic extract of madder, or by exhausting the root with water, precipitating with sulphuric acid, dissolving the moist precipitate in a solution of chloride of alumina, and separating the impure alizarin by the addition of hydrochloric acid. The impure alizarin is dissolved in alcohol, and separated as a lake on treating with hydrate of alumina, which is now boiled with carbonate of soda to separate another coloring matter called purpurin, and is finally treated with hydrochloric acid, which dissolves the alumina and leaves the pure substance.

ALKALI, a term originally applied to the ashes of plants, now employed in inorganic chemistry as a generic name given to the group of compounds that have the property of neutralising acids. The use of the term is, however, generally confined to such members of the group as are soluble in water.

ALKALOIDS, the name of a group of organic bodies that possess alkaline properties. They are characterised by the property of combining with acids to form salts, and many have the power of giving an alkaline reaction with vegetable colors.

ALKANET (*Alkanna tinctoria*, or *Anchusa tinctoria*), a plant of the order *Boraginaceae*, indigenous to the south of France and the shores of the Levant.

AL-KINDI, ABU YOSUF, &c., styled by pre-eminence "The Philosopher of the Arabs," flourished during the first half of the 10th century, and died at some unknown date posterior to 961. His literary activity was encyclopædic, and spread itself over all the sciences. The titles of his works number nearly 200 in the catalogue of Casiri, and amount to 265 in that of Flügel; but the latter appears in some cases to have enumerated the same works under two divisions, and it is doubtful whether the philosopher has not been confounded with another writer of the same name.

ALKMAAR, a town of the Netherlands, in the province of North Holland, situated on the Helder canal and on the railway between Haarlem and the Helder, about 20 miles N.N.W. from Amsterdam. Population, 14,048.

ALKMAAR, HEINRIK VON, the German translator of the celebrated satirical poem *Reineke de Vos*, flourished in the latter half of the 15th century.

ALL-SAINTS DAY, ALL-HALLOW'S, or HALLOWMAS, a festival, first instituted about 610 A.D., on the 1st of May, in memory of the martyrs, and celebrated since 844 on the 1st of November, as a general commemoration of all the saints. See BELTANE.

ALLAH, Arabic name for the one true God which is employed in the Koran, and has been adopted into the language of all Mahometan nations. See MAHOMETANISM.

ALLAHÁBÁD, a division, district, and city of British India, under the jurisdiction of the lieutenant-governor of the North-Western Provinces. Total population of division, 5,830,000.

ALLAHÁBÁD DISTRICT. In shape the district is that of an irregular oblong; and it is difficult accurately to describe its boundaries, as at one extremity it wanders into Oudh, while on the south the villages of the state of Rewah and those of this district are hopelessly intermingled. Roughly speaking, however, the boundaries may be described as follows:—On the north by the district of Jaunpur and by the Ganges; on the west by the districts of Fathipur and Bánda; on

the south by the independent state of Rewah; and on the east by the districts of Mirzápur and Jaunpur. The settlement of the district is at present undergoing revision; and as the measurements are still incomplete, it is impossible to state the exact area. For practical purposes, it may be estimated at 2802 square miles, or 1,793,906 acres, of which 1,065,990 acres are cultivated, and 727,916 acres are uncultivated; of this latter, however, there are about 250,000 acres capable of being brought under tillage, although not actually cultivated. The census of 1889 returned the population of the district at 1,394,245 souls, of whom 1,211,778 are Hindus, 181,574 Musselmans, and 893 Christians.

ALLAHÁBÁD CITY, the capital of the North-Western Provinces, is also the administrative headquarters of the Allahábád division and of the district of the same name. It is situated at the confluence of the Ganges and Jamná rivers. Population, (1901), 175,748.

ALLAMAND, JEAN NICOLAS SEBASTIAN, natural philosopher, born at Lausanne in 1713, was educated for the church, and held for a short time a clerical appointment at Leyden. Here he enjoyed the patronage and friendship of the celebrated S'Gravesende, who made him his literary executor. In 1747 he was appointed professor of philosophy and natural history at Franeker. He died at Leyden in 1787.

ALLAN, DAVID, a Scottish historical painter of considerable celebrity, was born at Alloa on the 13th of February, 1744. He died at Edinburgh on the 6th of August, 1796.

ALLAN, SIR WILLIAM, R. A., and president of the Royal Scottish Academy, was born at Edinburgh in 1782, and died February 22, 1850.

ALLANTOIS, a sac-like foetal membrane formed in the embryos of reptiles, birds and mammals, as an outgrowth from the posterior end of the alimentary canal, just in front of the anus. In all the higher animals it forms a large sac, enveloping the embryo outside the amnion.

ALLEGHANY, ALLEGHENY, or ALLEGANY MOUNTAINS, is the name often given to the Appalachian Mountains in the United States. See APPALACHIAN MOUNTAINS.

ALLEGHANY, a river of the United States, which rises in the north of Pennsylvania, and after flowing about 300 miles, first in a northerly, but for the greater part of its course in a westerly direction, during which it passes for a short distance into the state of New York, unites with the Monongahela at Pittsburg to form the Ohio.

ALLEGHENY CITY, one of the most progressive and prosperous cities in Pennsylvania, is beautifully situated on the right bank of the Allegheny river, at its junction with the Ohio. It is admirably located for business or residence purposes, handsomely laid out, well built, and in all respects presents an appearance both substantial and attractive. Lines of steamers afford regular and desirable means of communication with all points on the Ohio, Missouri and Mississippi rivers, and its railway facilities are available in all directions. The city contains eight banks; public and private schools, including two theological seminaries; between fifty and sixty churches, convents, asylums, retreats, etc., besides a very large number of stores of every description, with public buildings and private residences—models of construction, and architectural excellence—hotels, parks and places of public resort. The lines of manufacture carried on are extensive and varied, and their output supplies a demand in all sections of the United States. These industries embrace foundries and machine shops, locomotive and boiler works, cotton, woolen, saw and grist mills, tanneries, breweries, salt plants, hardware specialties, furniture

vehicles of every description, boots and shoes, etc., and other ventures of value and importance. The manufactures of the city, it may be added, are constantly increasing in number, and the inducements offered for the establishment of new enterprises cannot be overestimated. Street railways and electric lights are also employed. The population in 1900 was 129,896.

ALLEGIANCE, either derived from the French *allegiance* or taken from the same Latin source, has been used to express that duty which a person possessing the privileges of a citizen owes to the state to which he belongs; for a state to decide what persons are bound to it by allegiance may be easy, but for a man to know where his allegiance lies when two or more states claim him—and hence for jurists to decide what is the reasonable extent to which any state ought to make such a claim—is often involved in difficulty. The English doctrine, which was also adopted in the United States, asserted that allegiance was indelible; but this doctrine has been modified by the naturalization system.

ALLEGORY, a figurative representation conveying a meaning *other* than and in addition to the literal. It is generally treated as a figure of rhetoric, but the medium of representation is not necessarily language. An allegory may be addressed to the eye, and is often embodied in painting, sculpture, or some form of mimetic art. The etymological meaning of the word is wider than that which it bears in actual use. An allegory is distinguished from a metaphor by being longer sustained and more fully carried out in its details, and from an analogy by the fact that the one appeals to the imagination and the other to the reason.

ALLEGRI, ANTONIO. See CORREGGIO.

ALLEGRI, GREGORIO, musical composer, probably of the Correggio family, was born at Rome about 1580. He studied music under Nanini, the intimate friend of Palestrina. Being intended for the church, he obtained a benefice in the cathedral of Fermo. Here he composed a large number of motets and sacred pieces, which, being brought under the notice of Pope Urban VIII., obtained for him an appointment in the choir of the Sistine chapel at Rome. He held this from Dec. 1629 till his death on the 18th Feb. 1652.

ALLEGRO (Ital., "lively"), the fourth of the five principal degrees of movement in music; implying that the piece is to be performed in a quick or lively style.

ALLEINE, JOSEPH, Nonconformist divine, the author of *An Alarm to the Unconverted*—a book which remains as potential as when first modestly sent forth, scarcely second to Richard Baxter's *Call to the Unconverted*—was born in Devizes, England, in 1634. Desiring to study for the ministry, he was sent to Poulshot, then under a fellow of Oxford (William Spinage). On 6th July 1653 he took the degree of B. D., and thereupon became a tutor of his college. He became also chaplain of Corpus Christi, preferring this to a fellowship. In 1654 he had offers of high preferment in the state, which he declined. The succeeding year (1655) brought him another offer, which he did not decline. His public life—in preaching after the intense, awakening, wistful type; in catechising with all diligence and fidelity; in visitation among the poor and mean and sad; in letter-writing, tender and sympathetic; in devotional intercession through long consecrated hours of day and night—was a model of pastoral devotion. The year 1662 found senior and junior pastors like-minded, and both were of the Two Thousand. Alleine, when the Ejection blow fell, with John Wesley (grandfather of the celebrated John Wesley) for fellow-laborer, also ejected, carried on a kind of itineracy wherever opportunity was found for preaching the gospel. For this he was cast into prison, indicted at ses-

sions and suffered as hundreds of England's noblest men have suffered. His *Letters from Prison* were an earlier *Curdiphonia*. He was released on May 26, 1664; and in spite of the Conventicle Act (Five Mile Act) he returned to his beloved work as a preacher of the gospel. He found himself again in prison, and again and again a sufferer. He died November 17, 1668.

ALLEINE, RICHARD, M.A., author of *Vindiciæ Pietatis*, was educated at St. Albans Hall, Oxford, where Anthony à Wood states he was entered commoner in 1627, aged sixteen; and where, having taken the degree of B.A., he transferred himself to New Inn. He died December 22, 1681.

ALLEN, BOG OF, the name given to a congeries of morasses in Kildare and King's county, Ireland.

ALLEN, JOHN (1770-1843), was born near Edinburgh, and educated at the university of that city, where he took the degree of M.D. in 1791. With youthful enthusiasm, Allen joined the Scottish movement of that period for parliamentary reform.

ALLEN, or ALLEYN, THOMAS (1542-1632), a famous English mathematician, was born at Uttoxeter in Staffordshire, December 21, 1542. He was admitted scholar of Trinity College, Oxford, in 1561; and in 1567 took his degree of master of arts. In 1580 he quitted his college and fellowship, and retired to Gloucester Hall, where he studied very closely, and became famous for his knowledge of antiquity, philosophy, and mathematics.

ALLENTOWN, formerly called NORTHAMPTON, the county seat of Lehigh county, Penn., is handsomely situated on the Lehigh river, fifty-nine miles from Philadelphia and about ninety miles from New York city. The Lehigh Valley, Philadelphia and Reading, Central of New Jersey and Perkiomen railroads furnish transportation accommodations, and the city has grown rapidly in population, and as a manufacturing and trade center. It contains three banks, two daily and seven weekly papers, besides one semi-monthly and three monthly periodicals, two high schools, intermediate, grammar and primary schools—being also the location of Mühlenburg College, and the Allentown Female College—twenty-two churches, several well-managed hotels, an opera house, public halls, and a large number of stores. The manufactures of the city are conspicuously extensive. They embrace silk, hosiery, brushes, wall-paper, furniture, paints and oils, tube and coil, engines and machinery, hardware, brass goods, lumber (rough and planed), and other standard articles of commerce. Electricity and gas are employed for illuminating purposes. Population (1900), 35,416.

ALLESTRY, or ALLESTREE, RICHARD, D.D., was born at Uppington, in Shropshire, in 1619, and educated in the grammar school of Coventry. He died in January, 1681.

ALLEYN, EDWARD, eminent as a stage-player in the reign of Elizabeth and James I., but better remembered in after-times as the founder of Dulwich College, was born in London, in the parish of St. Botolph, Bishopsgate, on the 1st of September, 1566. He died in November, 1626.

ALLIANCE, a thriving town of Stark county, Ohio, is situated on the Mahoning river, at the junction of the Pittsburgh, Fort Wayne and Chicago, Cleveland and Pittsburgh, Alliance and Niles, and the Lake Erie, Alliance and Southern railroads, fifty-five miles from Cleveland. The city contains two banks, two weekly and one semi-weekly papers, twelve churches, high and intermediate schools, six hotels, an opera house, theater, and many stores; also manufactories of engines, boilers, steam hammers, agricultural implements, stone and hollow ware, white lead, lumber, etc. It is also the location of Mount Union College, and is an important

railroad center, the receiving and distributing point for a rich agricultural country, and is growing rapidly. The population in 1900 was 8,974.

ALLIER, a department in the center of France, containing an area of 2,821 square miles. Population in 1901 was 421,074.

ALLIER, the ancient *Elaver*, a river of France, which rises in the department of Lozère, among the Marge-ride mountains, a few miles east of the town of Mende, and, after traversing Haute Loire, Puy de Dôme, and Allier, forms the boundary between Cher and Nièvre, until it falls into the Loire four miles west of Nevers.

ALLIGATOR (probably derived from the Spanish *el lagarto*, the lizard), an animal so closely allied to the CROCODILE (*q.v.*) that some naturalists have classed them together as forming one genus.

ALLINGHAM, WILLIAM, born at Ballyshannon, Ireland, in 1828, became connected with the English periodical press, and in 1874 succeeded Froude as editor of *Frazer's Magazine*. He has also published several volumes of songs and stories, and a number of Irish ballads. He married, in 1874, Miss Helen Paterson, a noted artist in water-colors.

ALLITERATION. As Milton defined rhyme to be "the jingling sound of like endings," so alliteration is the jingle of like beginnings. All language has a tendency to jingle in both ways, even in prose. Thus in prose we speak of "near and dear," "high and dry," "health and wealth." But the initial form of jingle is much more common—"safe and sound," "thick and thin," "weal or woe," "fair or foul," "spick and span," "fish, flesh, or fowl," "kith and kin." The poets of nearly all times and tongues have not been slow to seize upon the emphasis which could thus be produced.

ALLIUM, a genus of *Liliaceæ*, containing over 150 species. Of these the most important economically are the onion, leek, garlic, and shallot. They are perennial, or more rarely biennial herbaceous plants, usually producing tunicated bulbs by their thickened and concentric leaf bases.

ALLIX, PIERRE, a distinguished divine of the French Reformed Church, was born at Alençon in 1641. He was pastor first at St. Agobile in Champagne, and then at Charenton, near Paris. He died in London in March, 1717.

ALLOA, a seaport town of Scotland, in the county of Clackmannan, situated on the north side of the Firth of Forth, twenty-five miles from Edinburgh, and six below Stirling, with which it is connected by rail. Population, 11,362.

ALLOCATION, "an address," is applied in the language of the Roman Catholic Church to denote especially the address delivered by the Pope to the College of Cardinals on any special occasion.

ALLODIUM, or ALODIUM, denotes lands which are the absolute property of their owner, and not subject to any service or acknowledgment to a superior. It is thus the opposite of *fe-odum* or fief.

ALLOPATHY, a mode of curing diseases by producing a condition of the system opposite to that characteristic of the disease; a name invented by Hahnemann for the standard system of medical treatment as opposed to HOMEOPATHY (*q.v.*)

ALLORI, ALESSANDRO, a painter of the Florentine school, was born at Florence in 1535, and died in 1607. He was very successful as a portrait painter.

ALLORI, CRISTOFANO, son of the preceding, was born in Florence, October 17, 1577, and died in 1621.

ALLOTROPY, a name applied to a property, whereby substances, chemically simple, assume different forms and conditions without undergoing chemical change.

ALLOXAN, a product of the action of oxidising

agents on uric acid to strong nitric acid of specific gravity 1.4, kept cool, and stirring constantly. It produces a great number of derivatives, for which see URIC ACID.

ALLOY, the name given to a combination obtained by fusing metals with each other. Few metals are employed in the pure state, with the exception of iron, copper, lead, tin, zinc, platinum, aluminum; metals are more frequently used in the forms of alloys for technical purposes. Every industrial application necessitates special qualities that may not occur in any isolated metal, but which may be produced by the proper mixture of two or more of these substances.

Alloys are equally interesting from a purely scientific point of view. They are not only mixtures of metals having certain particular qualities, but in reality are true chemical compounds, generally dissolved in an excess of one of the constituent metals. In the appearances which accompany the union of the metals, and in the properties of the resulting products, we observe that which characterizes the manifestation of affinity, that is, an evolution of heat and light, resulting in the formation of substances having a definite composition, distinct crystalline form, and a variety of properties different from those of the constituents.

Recently hydrogen, which, although a gaseous substance, has chemical properties resembling those of the true metals, has been combined with palladium, sodium, and potassium, producing compounds similar in properties to the recognized alloys.

PROPERTIES OF ALLOYS. *Density*.—If the density of any alloy is calculated from that of the components—assuming that there is no condensation of volume—the resulting number is sometimes greater than, equal to, or less than, the experimental result. Thus the alloys of gold and silver are less dense than the theoretical mean density; whereas brass and the alloys of lead and antimony vary in the opposite direction.

ALL-SAINTS' BAY, a magnificent natural harbor in the province of Bahia, Brazil, thirty-seven miles in length from north to south and twenty-seven miles from east to west.

ALL-SAINTS' DAY, otherwise ALL-HALLOWs or HALLOWMASS, is celebrated on November 1, the festival having been instituted by Gregory IV. in 835.

ALL-SOULS' DAY, a festival of the Roman Catholic Church, which falls on November 2nd.

ALLSPICE, the common name given to the spice prepared from pimento or Jamaica pepper, the fruit of *Eugenia pimenta* and *E. acris*.

ALLSTON, WASHINGTON, an eminent American historical painter and poet, was born November 5, 1779, at Waccamaw, in South Carolina, where his father was a planter. He early displayed a taste for the art to which he afterward devoted himself. He graduated at Harvard in 1800, and for a short time pursued his artistic studies at Charleston with Malbone and Charles Fraser. He then removed to London, and entered the Royal Academy as a student of Benjamin West, with whom he formed a lifelong friendship. In 1804 he repaired to Paris, and from that city, after a few months' residence, to Rome, where he spent the greater part of the next four years studying Italian art and Italian scenery. During this period he became intimate with Coleridge and Thorwaldsen. From 1809 to 1811 he resided in his native country, and from this latter date to 1817 he painted in England. After visiting Paris for a second time, he returned to the United States and practiced his profession in Boston (1818-30), and afterward at Cambridge, Massachusetts, where he died July 9, 1843. His first great painting, "The Dead Man Revived," executed shortly after his second visit to England, gained a prize of 200 guineas from the British Institu-

tion; in England he also prepared his "St. Peter Liberated by the Angel," "Uriel in the Sun," "Jacob's Dream," and "Elijah in the Wilderness." To the period of his residence in America belong "The Prophet Jeremiah," "Saul and the Witch of Endor," "Miriam," "Beatrice," "Rosalie," "Spalatro's Vision of the Bloody Hand," and the vast but unfinished "Belshazzar's Feast."

ALLUVION takes place where land is gained from the sea, lake or river by the washing up of sand and earth. The proprietor of the bank is the gainer.

ALLUVIUM, soil or land made up of the sediment deposited by running water. Rivers act on the rocks in their course both mechanically and chemically, and are in consequence always more or less loaded with detritus, which in its turn again aids the water in abrading other rocks. A great proportion of the matter with which the rivers are thus charged is carried out to sea. But in the level tracts, where the motion of the river is slow, it frequently overflows its banks, and leaves a sediment of earth, mud, gravel, etc.

ALMA, a river of Russia, in the southwest of the Crimea, which falls into the sea about sixteen miles north of Sebastopol.

ALMADEN, or ALMADEN DEL AZOQUE (in Arabic, the "Mine of Quicksilver"), a town of Spain, in the province of Ciudad Real, lies in the Sierra Morena, fifty-five miles southwest of the town of Ciudad Real. It is the *Sisapon* of the Romans, and is famous for its quicksilver mines, which have been worked extensively both in ancient and in modern times. Pop., 10,000.

ALMAGEST, compounded of the Arabic *al*, the name applied by the Arabians to their translation which contains a large collection of problems in geometry and astronomy. The translation was made about the year 827 A.D. by order of the caliph Al-Mamun.

ALMAGRO, a town of Spain, in the province of Ciudad Real, twelve miles east-southeast of the town of that name. Population about 15,000.

ALMAGRO, DIEGO DE, a Spanish commander, the companion and rival of Pizarro, was born at Aldea del Rey in 1475. He was executed by order of his former associate, Pizarro, in 1538.

ALMALI, a prosperous town of Asiatic Turkey, situated on the river Myra, twenty-five miles from its mouth, and fifty miles from Adalia. Population, 8,000.

ALMA MATER (Latin, "Nourishing mother"), is a name given to a university in relation to those who have received instruction from it.

AL-MAMUN (also written AL-MAMOUN, AL-MAMON, and simply MAMUN), one of the most renowned of the Abbasside dynasty of caliphs, was born in 786 A.D. He was the son of Harun-al-Raschid, whose caliphate is the golden age of Mahometan history. Harun, dying in 808, left the supremacy to his son, Al-Amin, Al-Mamun being at the time governor of Khorassan, and favorable to the succession of his brother. Irritated, however, by the treatment he received at the hands of Amin, and supported by a portion of the army, Mamun speedily betook himself to arms. The result was a five years' struggle between the two brothers, ending in the death of Amin October 4, 813, and the proclamation of Al-Mamun as caliph at Baghdad. In 833, after quelling Egypt, at least nominally, Mamun marched into Cilicia to prosecute the war with the Greeks; but with this expedition the career of one of the most famous of the caliphs was to terminate. He died near Tarsus, leaving his crown to a younger brother, Motassem. The death of Al-Mamun ended an important epoch in the history of science and letters, and the period of Arabian prosperity which his father's reign had begun. The influence of these two sovereigns is sometimes exaggerated; but there can

be no doubt we owe much to their exertions at a time when Europe was sunk in barbarism. Mamun was the author of *Inquiries into the Koran*, of a tract on the *Signs of Prophecy*, and of one on the *Rhetoric of the Priests and Panegyrists of the Caliphs*.

ALMANAC, a book or table, published from year to year, containing a calendar of the days, weeks, and months of the year, a register of ecclesiastical festivals and saints' days, and a record of various astronomical phenomena, particularly the rising and setting of the sun, the changes and phases of the moon, eclipses of the sun and moon, the times of high water at particular ports, &c. In addition to these contents, which may be regarded as essential to the almanac, it generally presents additional information, which is more or less extensive and varied according to the many different special objects contemplated in works of this kind. The derivation of the word is doubtful. The first syllable is the Arabic definite article; the rest of the word has been variously derived from the Greek *μήν*, a month; the Anglo-Saxon *mona*, the moon; and (which appears the most probable derivation) the Arabic *manah*, to reckon.

The CALENDAR will be treated in a separate article (which see).

The attention given to astronomy by Eastern nations, and the practice that prevailed among them of divination by means of the stars, must have led to the early construction of such tables as are comprised in our almanacs. Our information respecting these is extremely scanty; but we are not left in the same ignorance with regard to the practice of the ancient Romans. The peculiar arrangement of their calendar is well-known, and their *fasti sacri* or *kalendares* were very similar to modern almanacs. Originally knowledge of the calendar was confined to the class of pontifices or priests, whom the people had to consult not only about the dates of the festivals, but also regarding the proper times of instituting various legal proceedings. But about 300 B.C. one Cn. Flavius, the secretary of Appius Claudius, possessed himself of the secret, either by the stealthy use of documents in the possession of his master, or, according to Pliny, by repeatedly consulting the pontifices and jurists, and collating the particulars of the information he obtained

from them. It was neither more nor less than publishing an almanac when, as Livy relates, he exhibited the *fasti* on white tablets round the forum. From this time tablets containing the calendar, the festivals, astronomical phenomena, and sometimes historical notices, seem to have been common. The *Fasti* of Ovid is a poetical relation of incidents and traditions connected with the calendar. The researches of antiquaries have brought to light numerous *fasti* or *calendaria* cut on marble and other kinds of stone. Representations of several of these will be found in Gruter's *Inscriptiones*. One figured there, the Farnese rustic calendar, is a circular block of stone, on each of the four vertical faces of which three columns are engraved, detailing for each different month the number of days, the date of the *nones*, the length of the day and night, the sun's place in the zodiac (which is also indicated by a representation of the sign at the top of the column), the tutelary deity of the month, the rural operations of the season, and the chief festivals.

Almanacs of a ruder kind, known as *clogg almanacs*, were in use in some parts of England as late as the end of the 17th century.

The earliest almanac regarding which Lalande (whose *Bibliographie Astronomique*, Paris, 1803, is the best authority on publications of this kind) could obtain any definite information belongs to the 12th century. Manu-

script almanacs of considerable antiquity are preserved in the British Museum and in the libraries of Oxford and Cambridge. Of these the most remarkable are a calendar ascribed to Roger Bacon (1292), and those of Peter de Dacia (about 1300), Walter de Elvendene (1327), John Somers (1380), &c. It is to be remembered that early calendars (such as the *Kalendarium Lincolnense* of Bishop Robert Grosseteste) frequently bear the names, not of their compilers, but of the writers of the treatises on ecclesiastical computation on which the calendars are based. In 1812 there was printed at Hackney what purported to be a transcription of the greater part of an almanac for 1386. This, if it exists, must be one of the earliest, perhaps the earliest, in the English language that has been preserved. The earliest English calendar in the British Museum is one for the year 1431. The first printed almanac known is one for the year 1457; the first of importance is that of Joannes de Monte-Kegio, better known as Regiomontanus, which appears to have been printed at Nuremberg in 1472. In this work the almanacs for the different months embrace three Metonic cycles, or the 57 years from 1475 to 1531 inclusive.

The variety of extraneous matter included in almanacs, corresponding to the very numerous other objects to which the almanac proper is often only secondary, can be merely alluded to here. A number of publications, issued in Germany from the middle of the 18th to the middle of the 19th century, under such titles as *Musenalmanach*, or *Almanach des Muses*, contain some of the best works of some of the most celebrated German poets. The *Almanach de Gotha*, which has existed since 1764, and is published at present both in French and German, gives a particular account of all the royal and princely families of Europe, and ample details, compressed into little space, concerning the administration and the statistics of the different states of the world. As works of general statistical reference, the two national almanacs, *Oliver and Boyd's New Edinburgh Almanac* (from 1837) and *Thom's Irish Almanac* (from 1843) are of very great value.

The *Nautical Almanac* is a publication the object of which is to supply information that is indispensable to the navigator and the astronomer. It gives with the utmost precision the positions of the principal heavenly bodies at short intervals of time, and other important details of celestial phenomena. The moon's exact position is registered for every hour, and also the angular distances at noon and midnight daily of the moon from the sun and several fixed stars. By means of the data thus supplied, in connection with observations of the heavenly bodies, time, latitude, and longitude can be determined. The *Nautical Almanac* has been published regularly since the issue in 1766 of the *Almanac for 1767*. It was originated by Dr. Maskelyne, the astronomer-royal, who conducted it for many years.

In America the best statistical almanacs are published yearly by the leading daily newspapers, in which a vast amount of information is compiled, while the forecasts of weather and all meteorological phenomena are made in the reports of the United States signal service, whose stations are distributed all over the country.

ALMANSA, a town of Spain, in the province of Albacete, 35 miles E.S.E. of the town of that name, on the Madrid and Alicante railway. Population, 8,000.

ALME, or ALMIA (from *álím*, wise, learned), the name of a distinct class of singing girls in Egypt.

ALMEIDA, a strongly-fortified town of Portugal, in the province of Beira, situated between the Coa and the Duas Casas, a branch of the Agueda, 95 miles northeast of Coimbra, and 25 miles from the Spanish fortress of Ciudad Rodrigo. Population (1890), 1,696.

ALMEIDA, DON FRANCISCO DE, the first viceroy of Portuguese India, was born at Lisbon about the middle of the 15th century. He was the seventh son of the second Count of Abrantes, and thus belonged to one of the most distinguished families of Portugal. In his youth he took part under Ferdinand of Aragon in the wars against the Moors (1485-92). In March 1505, having received from Emmanuel I. the appointment of viceroy of the newly-conquered territory of India, he set sail from Lisbon in command of a large and powerful fleet, and arrived in July at Quiloa, which yielded to him almost without a struggle. A much more vigorous resistance was offered by the Moors of Mombaza, but the town was taken and destroyed, and its large treasures went to strengthen the resources of Almeida. At other places on his way, such as the island of Angediva, near Goa, and Cananore, he built forts, and adopted measures to secure the Portuguese supremacy. On his arrival in India he took up his residence at Cochín, where a Portuguese fort had been built by Albuquerque in 1503. The most important events of Almeida's brief but vigorous administration were the conclusion of a commercial treaty with Malacca, and the discoveries made by his son Lorenzo, who acted as his lieutenant. The latter was probably the first Portuguese who visited Ceylon, where he established a settlement, and is also celebrated as the discoverer of Madagascar and the Maldivé islands. He was killed by savages at Saldauha, South Africa, March 1, 1510.

ALMERIA, a modern province of Spain, comprehending the eastern portion of the ancient kingdom of Granada. It is bounded on the N. by Jaén and Murcia, on the E. and S. by Murcia and the Mediterranean, and on the W. by Granada; with an area of about 3300 square miles. The province is traversed by mountain ridges, some of them of considerable elevation, with corresponding valleys and plains of great fertility. The principal sierras are those of Maria, Almahilla, Cabrera, Almagrera, Gata, and Gador, and in the W. some offshoots of the Sierra Nevada. The inhabitants are principally engaged in mining and agriculture. Many of the proprietors farm their own land, the number of landed properties being 44,858, while the tenants are only 7356. Of the area of the province, 376,698 acres are arable and pasture land; 13,538 acres vineyards; 5360 acres olive plantations; 30,797 acres cultivated mountain and wood lands; and 1,686,738 acres uncultivated. There are 438,357 head of live stock. All kinds of grain are raised in abundance. The common fruits are plentiful, as well as oranges, lemons, and vines. Much excellent silk is produced in the western districts; cotton is raised to some extent along the coast, and the sugarcane is also cultivated. Cattle are extensively bred; those of the valley of the Almería are especially remarkable for their size and beauty. The province is one of the richest in minerals of all Spain. The population in 1897 was 344,681.

ALMERIA, the capital of the above province, lies on the Gulf of Almería, on the Mediterranean, 72 miles east-southeast of Granada. From the strength of the port it was deemed by the Moorish kings of Granada one of the most valuable of their fortresses and their best commercial harbor. Population (1897), 46,806.

ALMOHADES (*Almoahedun*, Unitarian), a Mahometan dynasty that flourished in Africa and in Spain during the 12th and 13th centuries. Mohammed-Ibn-Abdallah, the founder of the Almoahedun sect, was the son of a lamplighter in the great mosque at Sous-el-Aksa. He studied at Cordova, and afterwards visited Cairo and Baghdad, where he became the disciple of the famous philosopher Algazali. In order to establish his power with his countrymen, he connected himself

with Abd-el-Mumen, a young Mussulman of great abilities, whom he sent forth as his apostle to propagate the new doctrine (1116-17); while in his own person he affected an unusual degree of piety and mortification, appearing in tattered garments, and interdicting the use of wine and music and every gratification of the senses. His fame spread rapidly among the mountain tribes of Mahgreb, and the ignorant multitude adopted his opinions with eager zeal. His followers saluted him as the Al-Mehidi on the 28th November 1121. Entering the city of Morocco, this new prophet foretold the downfall of the existing dynasty, and mocked the authority of the reigning prince Ali-Ibn-Yussef. Ali, lulled in security, despised his predictions as the mere ravings of a fanatic; and it was not without some difficulty that he was at length prevailed on to banish him from the city. Mohammed retired to the mountains, and fortified the town of Tinnal, which he defended against every assault of his enemies (1123). His retreat became the rendezvous of a numerous sect, who assumed the title of Almoahedi, or Almohades, and asserted that they alone of all the Mussulmans maintained the religion of Islam in its original purity. Yet notwithstanding the great success of the Almohades, the vast empire of the Almoravides was not at once subdued; and Mohammed, after an ineffectual attempt to reduce the city of Morocco, died in the year 1130, having failed to accomplish the object of his ambition, the possession of a throne.

See **ALMORAVIDES**.

ALMON, JOHN, a political pamphleteer and publisher of considerable note, was born at Liverpool about 1738. He came to London in 1758, and at once commenced a career which, if not important in itself, had a very important influence on the political history of the country. The opposition, hampered and harassed by the government to an extent that threatened the total suppression of independent opinion, were in great need of a channel of communication with the public, and they found what they wanted in Almon. He had become personally known to the leaders through various publications of his own which had a great though transient popularity; the more important of these being *The Conduct of a late Noble Commander* [Lord George Sackville] *Examined* (1759); a *Review of the Reign of George II.*, published on the death of that monarch; a *Review of Mr. Pitt's Administration* (1761); and a collection of letters on political subjects. The review of Pitt's administration passed through four editions, and secured for its author the friendship of Lord Temple, to whom it was dedicated. Being thus in the counsels of the party, he was persuaded in 1763 to open a bookseller's shop in Piccadilly, chiefly for the publication and sale of political pamphlets. As he generally received with every pamphlet a sum sufficient to secure him against all contingencies, it cannot be said that he acted entirely from disinterested or patriotic motives. At the same time, he deserves the credit of intrepidity; and it cannot be denied that, whether he knew the full value of the principle for which he was contending or not, he did very much to secure the freedom of the press. The government of course were not unobservant of Almon's proceedings, and, as has often been the case, strengthened his influence by the very measures they took to repress it. In 1774 Almon commenced the publication of his *Parliamentary Register*, and he also issued an abstract of the debates from 1742, when Chandler's Reports ceased, to 1774. About the same time, having earned a competency, he retired to Boxmoor in Hertfordshire, though he still continued to write on political subjects. He afterwards became proprietor of the *General Advertiser*, in the management of which he lost his fortune,

and was declared insolvent. He died on the 12th December 1805. A complete list of Almon's works, most of which appeared anonymously, is given in Watt's *Bibliotheca Britannica*. Though their literary merit is not great, they are of very considerable value to the student of the political history of the period.

ALMOND. This is the fruit of *Amygdalus communis*, a plant belonging to the natural order Rosaceæ, sub-order Amygdaleæ or Drupifereæ. The tree appears to be a native of Asia, Barbary, and Morocco; but it has been extensively distributed over the warm temperate region of the Old World. It is a tree of moderate size; the leaves are oblong-lanceolate, and serrated at the edges; and the flowers which appear early in the spring, are of a pink color. The fruit is a drupe, having a downy outer coat, called the epicarp, covering a tough portion called the mesocarp, which encloses the reticulated hard stony shell or endocarp. The seed is the kernel which is contained within these coverings. The shell-almonds of trade consist of the endocarps enclosing the seeds. The tree grows in Syria and Palestine; and is referred to in the Bible under the name of *Shaked*, meaning "hasten." The tree seldom exceeds twelve to sixteen feet in height. There are two varieties of the plant, the one producing sweet, the other bitter almonds. The kernel of the former contains a fixed oil of emulsin; while that of the latter has in addition a nitrogenous substance called amygdalin, which, by combination with emulsin, produces a volatile oil and prussic acid.

ALMONDBURY, and extensive parish and township of Yorkshire in England, lying to the southeast of Huddersfield. Population over 60,000.

ALMONER, in its primitive sense, denotes an officer in religious houses, to whom belonged the management and distribution of the alms of the house.

LORD ALMONER, or **LORD HIGH ALMONER OF ENGLAND**, is an ecclesiastical officer, generally a bishop, who has a right to the forfeiture of all deadlands and the goods of a *felo de se*, which he is to distribute among the poor. See **MAUNDY THURSDAY**.

ALMORÁ, the principal town in the British district of Kumáon, within the lieutenant-governorship of the North-Western Provinces. The town is built on the crest of a ridge of the Himalayas, running east and west, and 5337 feet above sea-level. It consists chiefly of a single street, about 50 feet wide and three-quarters of a mile long, closed by a gate at each end. A few detached houses, inhabited by Europeans, are scattered along the face of the mountain. Population, 7,139.

ALMORAVIDES, a family of Mahometan princes who reigned in Africa and in Spain between 1073 and 1147 A.D. This appellation was derived from the sect of *Al-Morabethun* (Dedicated to the service of God), which arose about the middle of the 11th century, among a poor ignorant tribe of Berbers inhabiting the mountains of Atlas, on the shores of the Atlantic Ocean. Few kings have received so noble a heritage as that to which Ali succeeded. The first years of his reign were prosperous, though disturbed by the Almohades, who were preparing the way for the destruction of the Almoraides. Ali was at last obliged to recall from Spain his son Tashfyn, who was using his utmost endeavors to oppose the victorious career of Alfonso of Aragon, surnamed the Fighter. But the valor of Tashfyn was of little avail against the rising power of the Almohades; disaster followed disaster; and when, in 1143, he succeeded to the throne, but a moiety of the kingdom remained. Driven from Tlemecen, he sought refuge in Oran; but Abd-el-Mumen appeared before its walls, and by threats so intimidated the inhabitants that Tashfyn was compelled to attempt

escape on horseback, with his favorite wife behind him; but being closely pursued, he urged his horse over a precipice, and with his wife was dashed to pieces. With Tashfyn expired the domination of the Almoraides; for although they still remained in possession of the city of Morocco, their power was completely broken.

ALMQVIST, KARL JONAS LUDWIG, one of the most extraordinary figures that the history of literature can produce, was born at Stockholm in 1793. He began life under highly favorable auspices; but becoming tired of a university career, he threw up the position he held in the capital to lead a colony of friends to the wilds of Wermland. This ideal Scandinavian life soon proved a failure; Almqvist found the pen easier to wield than the plough, and in 1829 we find him once more settled in Stockholm. Now began his literary life; and after bringing out several educational works, he made himself suddenly famous by the publication of his great novel, *The Book of the Thorn-Rose*. The career so begun developed with extraordinary rapidity; few writers have equalled Almqvist in productiveness and versatility; lyrical, epic, and dramatic poems; romances; lectures; philosophical, æsthetical, moral, political, and educational treatises; works of religious edification, studies in lexicography and history, in mathematics and philology, form the most prominent of his countless contributions to modern Swedish literature. Almqvist died in 1866.

ALMUG or ALGUM TREE. The Hebrew words *Almuggim* or *Algummin* are translated Almug or Algum trees in our version of the Bible. The wood of the tree was very precious, and was brought from Ophir (probably some part of India), along with gold and precious stones, by Hiram, and was used in the formation of pillars for the temple at Jerusalem, and for the king's house; also for the inlaying of stairs, as well as harps and psalteries.

ALMUNECAR, a small seaport town of Spain, in the province of Granada, about thirty-three miles south of the town of that name. Population about 9,000.

ALNWICK, the county town of Northumberland, is situated on the south bank of the river Alne, 310 miles north of London, 34 north of Newcastle, and 29 south of Berwick. There are remains of the old wall which surrounded the town, and one of the four gates still exists; but most of the houses are comparatively modern, and are laid out in spacious streets. Population, 7,044.

ALOE. Aloes is a medicinal substance used as a purgative, and produced from various species of aloes, such as *A. spicata*, *vulgaris*, *socotrina*, *indica* and *purpurascens*, all belonging to the natural order Liliaceæ. Its active principle is *aloin*, and, while very useful as a purgative, it also contains emmenagogue properties.

The plant called American aloes belongs to a different order, viz., Amaryllidaceæ. The plant is called *Agave Americana*. The juice of the plant, taken immediately before flowering, is used in America for the manufacture of an intoxicating beverage. In Ecuador the spongy substance of the flower stem is used instead of tinder, and in the schools the green leaves serve as paper.

ALOIDÆ, or **ALOIDÆ**, the designation of Otus and Ephialtes, sons of Poseidon by Iphimedeia, wife of Aloeus. They are celebrated for their extraordinary stature, being 27 cubits in height and 9 in breadth when only nine years old.

ALOMPRA, **ALOUNG P'HOURA**, founder of the last dynasty in Burmah, was born in 1711 at Moncha-boo, a small village fifty miles northwest of Ava. Of humble origin, he had risen to be chief of his na-

live village when the invasion of Birmah by the king of Pegu in 1752 gave him the opportunity of attaining to the highest distinction. The whole country had tamely submitted to the invader, and the leading chiefs had taken the oaths of allegiance. Alompra, however, with a more independent spirit, not only contrived to regain possession of his village, but was able to defeat a body of Peguan troops that had been sent to punish him. Upon this the Birmanese, to the number of a thousand, rallied to his standard, and marched with him upon Ava, which was recovered from the invaders before the close of 1753. For several years he prosecuted the war with uniform success. In 1757 he had established his position as one of the most powerful monarchs of the East by the invasion and conquest of Pegu. Against the Siamese, who were also suspected of having abetted the Peguan rebels, he proceeded more openly and severely. Entering their territory, he was just about to invest the capital when he was seized with an illness which proved fatal on the 15th May 1760. Alompra is certainly one of the most remarkable figures in modern Oriental history.

ALOST, or AALST, a town of Belgium, on the eastern frontier of the province of East Flanders, about midway between Ghent and Brussels. The French under Turenne took it in 1667, but were obliged to abandon it after the battle of Ramillies in 1706. Population (1900), 30,069.

ALPACA is a name applied generally to several allied South American wool-bearing animals, but more properly restricted to one of the species. It is further used to distinguish the wool obtained from these animals, and the woven textures manufactured from the wool are also known as alpacas. The alpacas or llamas are natives of the lofty table-lands and mountain-range of the Andes in Peru and Chili, and in that region of the globe they long occupied the position held in the Old World by their congeners of larger size, the camels. A great deal of doubt and confusion has existed as to the number of species into which the llamas can be divided—a very common occurrence in dealing with domesticated or semi-domesticated creatures. Most authorities now, however, agree in regarding them as separable into four species, following the classification of Von Tschudi, who has given much careful consideration to the subject. The species, according to that naturalist, are the llama (*Auchenia lama*), the guanaco or guanaco (*A. guanaco*), the alpaca or paco (*A. paco*), and the vicugna (*A. vicugna*.) The two first-named species are, or rather were, more valued as beasts of burden, and for their flesh, than as sources of wool, being able to bear from 120 to 150 lb. burden over long distances daily. The guanaco attains a size not much less than the red deer; and is the largest and most widely spread of all the species, being found from the equator southward to Patagonia. The llama is next in size, but its habitat is limited to the loftier mountains of North Peru. Although both species yield a serviceable quality of wool, which is used by the Peruvians and found in commerce, it is chiefly to the alpaca we owe the supply of wool imported into this country under that name. In its native condition the alpaca ranges between 10° and 20° S. lat., from the centre of Peru into Bolivia, not coming lower down in vertical distribution than between 8000 and 9000 feet above the sea-level. The wool, which varies in length from 2 to 6 inches, is of a very lustrous and fine quality, and is mostly white, black, or gray, shades of brown or fawn being rarer.

There is evidence of these animals having been held domesticated and used for their wool in their native regions from remote antiquity. Remains of clothing made from alpaca wools have been found in the graves

of the Incas; and when, in the early part of the 16th century, Europeans first visited Peru, these animals formed the chief wealth of the natives, being the carriers of their commerce as well as the main source of their food and clothing.

ALP ARSLAN or AXAN, MOHAMMED BEN DAOUD, the second sultan of the dynasty of Seljuk, in Persia, and great-grandson of Seljuk, the founder of the dynasty. He was born in the year 1029 A.D., 421 of the Hegira. He assumed the name of Mohammed when he embraced the Mussulman faith; and on account of his military prowess he obtained the surname of *Alp Arslan*, which signifies "a valiant lion." He was killed December 15, 1072, while attempting the conquest of Turkestan.

ALPENA, the county seat of Alpena county, Mich., is situated on the north side of Thunder Bay, an inlet of Lake Huron, at the mouth of Thunder Bay river, and is the northern terminus of the Detroit, Bay City and Alpena railroad. The city is distant 245 miles from Detroit, and 140 from Bay City, with both of which points it is connected by rail and steamer, and is extensively engaged in the manufacture of lumber, which is largely shipped to the East and Europe. Its fishing interests are also large. The city contains several banks, churches, and weekly papers, a graded school system, large number of stores, foundries, and machine shops, fiber works, electric light works, saw, planing, and shingle mills, and other enterprises of a commercial and manufacturing character. The city is lighted by gas and electricity, and is well equipped in its various departments. The center of an agricultural and lumber region, Alpena offers various attractions for investment. Population, 11,802.

ALPES, the name of three departments in the south-east of France—*Basses Alpes*, *Hautes Alpes*, and *Alpes Maritimes*.

BASSES ALPES is bounded on the N. by the department of Hautes Alpes; on the E. by the kingdom of Italy and the department of Alpes Maritimes; on the S. by the departments of Var and Bouches du Rhône; and on the W. by those of Vaucluse and Drôme.

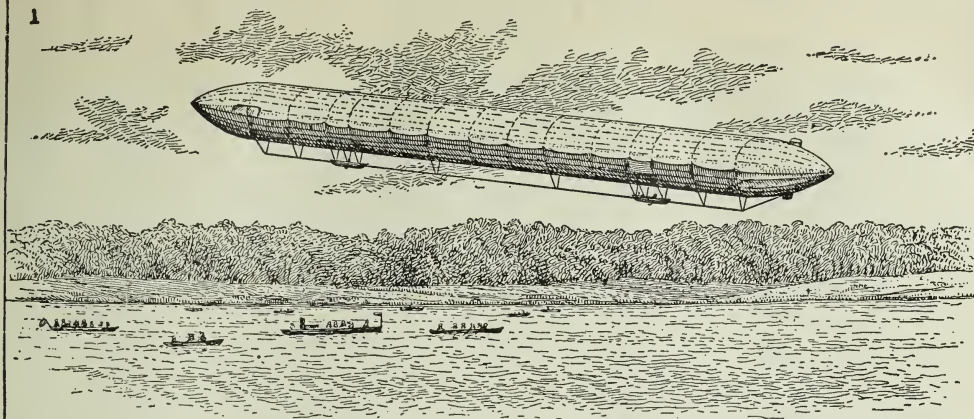
HAUTES ALPES is bounded on the N. by the departments of Isère and Savoie; on the E. by the kingdom of Italy; on the S. by the department of Alpes Basses; and on the W. by that of Drôme. It extends nearly 80 miles from N.E. to S.W., and contains an area of 2158 square miles. Population, (1901), 106,857.

ALPES MARITIMES, bounded on the N. by Basses Alpes and the kingdom of Italy, which also forms its boundary on the E.; on the S. by the Mediterranean Sea; and on the W. by Var and Basses Alpes. It extends at the widest points 55 miles from N. to S., and 50 from E. to W., and contains an area of 1517 square miles. Nice is the capital; and among the other towns are Mentone, Villafranche, Grasse, Antibes, Cannes, and Puget Théniers. The Marseilles, Nice, and Ventimille railway, skirting the coast, connects Cannes, Antibes, Nice, and Mentone, and joins an Italian line which affords direct railway communication with Genoa. The department of Alpes Maritimes was formed in 1860 from the territory of Nice, which had been ceded to France, together with Mentone and Roccabruna, purchased from the Prince of Monaco, and the arrondissement of Grasse, transferred from Var. It had a population of 320,822 in 1901.

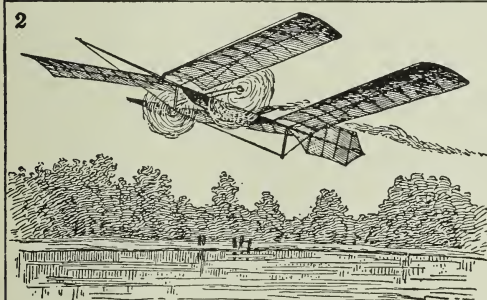
ALPHA and OMEGA, the first and last letters of the Greek alphabet, frequently employed to symbolise the idea of completeness or infinity.

ALPHABET. By an alphabet we mean a list of symbols which represent conventionally to the eye the sounds which are heard in the speech of a nation. An

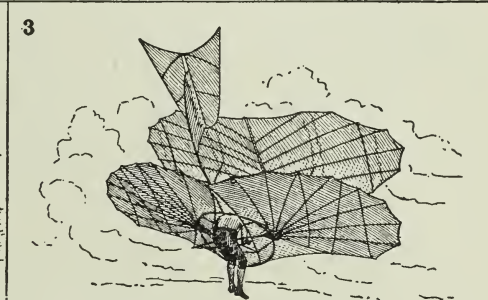
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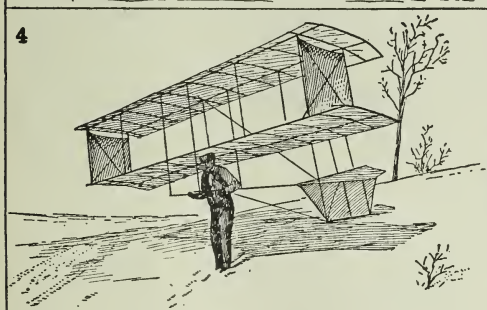
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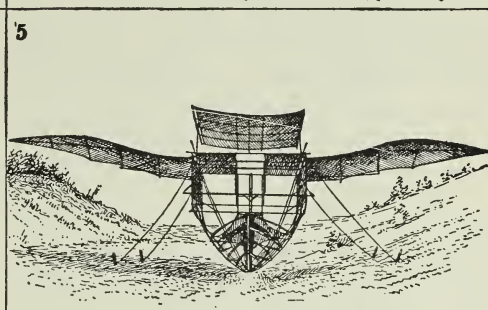
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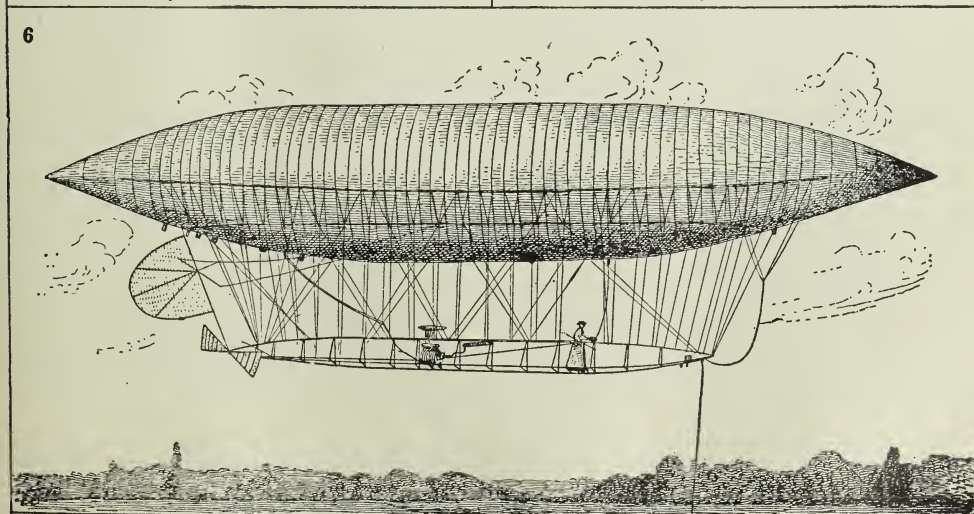
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6



1. DIRIGIBLE BALLOON OF COUNT ZEPPELIN,
In flight, July 2, 1900.
2. LANGLEY'S AERODROME, In flight:

3. LILIENTHAL'S APPARATUS FOR SOARING FLIGHT.
4-5. CHANUTE'S APPARATUS FOR SOARING FLIGHT.
6. SANTOS-DUMONT'S AIRSHIP.

ALPHABETS

HEBREW NAMES	GREEK NAMES	HEBREW	PHŒNICIAN	EARLIEST GREEK	EAST GREEK (MILITAS)	WEST GREEK	LATER GREEK	EARLY LATIN	LATER LATIN
ALEPH	ALPHA	א	𐤀	A	ΑΑ	A	A	ΑΔ	A
BETH	BETA	ב	𐤁	B	B	B	B	[Β]	B
GIMEL	GAMMA	ג	𐤂	Γ	ΓΑ	ΓC	Γ	C	C
DALETH	DELTA	ד	𐤃	Δ	Δ	ΔΔD	Δ	Δ	D
HE	EPSILON	ה	𐤄	ΕΕ	ΕΕ	ΕΕ	E	E	E
VAU	(DIGAMMA)	ו	𐤅	ϜϜ	(F)	[F]		[F]	F
ZAIN	ZETA	ז	𐤆	I	I	I	Z		(G)
CHETH	ETA	ח	𐤇	Θ	ΘH	ΘH	H	Θ	H
TETH	THETA	ט	𐤈	⊕	⊕⊕	⊕⊙	⊙		
IOD	IOTA	י	𐤉	ΙΙ	I	I	I	I	I
CAPH	KAPPA	כ	𐤊	ΚΚ	K	K	K	K	K
LAMED	LAMBDA	ל	𐤋	Λ	ΛV	ΛL	Λ	L	L
MEM	MU	מ	𐤌	ΜΜ	M	ΜΜ	M	Μ	M
NUN	NU	נ	𐤍	N	N	ΝΝ	N	Ν	N
SAMECH	(xi)	ס	𐤎		Ξ		Ξ		
AIN	OMICRON	ע	𐤏	Ο	O	O	O	O	O
PE	PI	פ	𐤐	ΠΠ	Π	ΠΠ	Π	Π	P
TZADE		צ	𐤑	Μ	(M)				
KOPH	(KOPPA)	ק	𐤒	Ϙ	Ϙ	Ϙ		Ϙ	Q
RESH	QHO	ר	𐤓	ΡΡ	ΡΡΡ	ΡΡ	P	P	R
SHIN	SIGMA	ש	𐤔	Σ	ΣΣ	ΣΣ	Σ	Σ	S
TAU	TAU	ת	𐤕	T	T	T	T	T	T
	U-PSILON			ΥV	ΥV	ΥV	Υ	VY	V
	PHI				ΦΦ	[+X=ξ]	Φ	+	X
	CHI				Χ	[ΦΦ=φ]	Χ		
	PSI				ΨΥ	[ΥV=χ]	Ψ		
	OMEGA				Ω		Ω		

alphabet will therefore be perfect if the number of its symbols exactly corresponds to the number of simple sounds which are commonly distinguishable in the spoken language. But this perfection has probably never yet been reached; all known alphabets have failed, either by defect, *i.e.*, from not representing all the simple sounds; or by redundancy, in having more than one symbol for the same sound. They must also necessarily become imperfect by lapse of time. No nation keeps the sound of its language unaltered through many centuries; sounds change as well as grammatical forms, though they may endure longer, so that the symbols no longer retain their proper values; often, too, several different sounds come to be denoted by the same symbol; and in strictness the alphabet should be changed to correspond to all these changes. But little inconvenience is practically caused by the tacit acceptance of the old symbol to express the new sound; indeed the change in language is so gradual that the variation in the values of the symbols is imperceptible.

The term alphabet has come to us from the Latin *alphabetum*, which, however, occurs in no prose writer before Tertullian. It could not have been used, for metrical reasons, by Juvenal, when he wrote, "*Hoc discunt omnes ante alpha et beta puellæ*"—their A B C. But there is no reason why it should not have existed earlier; the word was borrowed from the Greek, as seems clear from the compound *αβα*, which is as old as the comedian Philyllus, and he was alive in 392 B.C. It does not seem likely that this compound adjective would have been coined if the noun itself had not already existed in the same sense which it now bears.

The symbols of our alphabet are nearly those of the Latin; these in their turn were borrowed from a Greek alphabet; and there seems no reasonable ground for doubting the common tradition that the Greeks derived their characters from a Phœnician source. All these borrowings will be fully described hereafter. At this point absolute certainty ends. We cannot prove to demonstration the origin of our alphabet; but positive facts and analogical arguments may be adduced which enable us to attain a very high degree of probability. It is now commonly believed that the characters were originally hieroglyphics, and in that ultimate form were devised in Egypt. There, for convenience of writing, they took a simpler form (called hieratic). In this shape they were borrowed by the Phœnicians; and thus, in their long course down to us, they passed gradually from being the written expression of an idea into the written expression each of a single sound. It is true that the proof is not clear throughout; sometimes the links are feeble, and here we have to employ the analogy of other languages, in which the particular step which we want to prove has undoubtedly been made under similar circumstances. Still, it may with some truth be said that we can only prove the possibility of such a process, while any given alphabet may have had a perfectly independent origin; the Phœnician alphabet *may* have been developed in Phœnicia itself, and never been hieroglyphic at all. But this is very difficult to conceive. The *a priori* argument for the derivation of phonetic from hieroglyphic characters is strong. Hieroglyphics have unquestionably been the first attempt of many nations in a rude state to record their thoughts in a permanent and universally intelligible form. It is also certain that these hieroglyphics have undergone progressive degradations of shape, so that their visible connection with the thing signified was often lost; they became in many cases the expression of those combinations of sounds by which the things were denoted in the spoken language, though they still generally retained their original value as well. Here, at

all events, a certain connection between hieroglyphics and sounds establishes itself; and *a priori* it is more probable that all alphabets should have derived the single sounds of which they consist from hieroglyphics, through the medium of their derived phonetic values, than that any alphabet should have been produced independently of hieroglyphics (which are admitted to have existed), by some arbitrary process of formation for which absolutely no testimony can be adduced. As we have said above, such a process is not impossible, and may be true for any particular alphabet; but the opposite theory has the most internal probability and all the evidence of which the case admits. Against this it seems insufficient to urge (as has been done) that there exist upon earth savages who have never developed any alphabetic writing out of their rude attempts—a fact which may be readily granted; or that civilised men often return to the simple methods employed by uncivilised nations, such as cutting notches on sticks or tying knots in strings—such return being apparently adduced to prove that two totally different methods of expression can co-exist without there being any tendency to pass from one to the other; nay, it is added that in Egypt the hieroglyphic and the common (or demotic) character did certainly exist side by side; and if the latter were borrowed from the former, it would have superseded it, which it did not do. Now, in answer to this, reasons will appear shortly why the hieroglyphic characters lingered so persistently, even when the later phonetic character was in common use—nay, in the very same inscription or document with the hieroglyphic. Still, the argument would have some weight if it were not grounded on the false assumption that the demotic alphabet was a *purely* phonetic one, totally unconnected with its more aged rival. But modern research has proved incontestably that the demotic characters can be traced back to their original hieroglyphic shape through the medium of the hieratic; in fact, that the cumbrous hieroglyphics were successively put into more abbreviated shapes, for convenience of writing, as their use increased.

Excluding, then, attempts of savages such as have been mentioned above, which were neither durable nor intelligible enough to make them of service, except for the smallest number of men during the most limited time—excluding these as not deserving the name, we derive all real writing from hieroglyphics, such hieroglyphics being either purely pictorial, the expression of visible objects in the external world; or symbolic, when some external object is conventionally chosen to represent some action or some abstract idea. These two methods were probably nearly contemporaneous in their origin, because the necessity of writing at all supposes a considerable advance in civilisation, and therefore a considerable development of ideas. To this system, as a whole the convenient term *ideography* is now generally applied. From this men have passed to phonetic writing, first, apparently, in the form of *syllabism*, in which each syllable of a word is regarded an independent whole and represented by a single sign; then from this to *alphabetism*, in which the syllable is no longer denoted by an indivisible symbol, but is resolved into vowel and consonant, each with its own accepted sign.

It seems probable that all known alphabets (with one or two possible exceptions) may be traced back to four or five parents. These have differed much in fruitfulness, but all were originally hieroglyphic. These five systems of writing are the Egyptian, the cuneiform, the Chinese, the Mexican or Aztec, and the curiously cumbrous character of Yucatan and Central America: these last may be seen interspersed with figurative paintings in a facsimile given by M. de Rosny at p. 20 of his *very*

useful little summary, *Les Ecritures Figuratives Les Different Peuples Anciens et Modernes*. Of these, the first three alone can be said to have had any great extension; and the first, if the Phœnician, and by consequence the European alphabets, were derived from it, far exceeds in importance all the rest together. These systems were perfectly independent, and developed themselves, each in the same course, but in its own manner, and each in the main to a different degree. At certain points in their history all but one became crystallised, and remained to show us the steps by which the progress to phonetism can be made. We do not propose to describe here fully any of these systems of hieroglyphics. We are only concerned to point out their relative degrees of development, their deficiencies, and the consequent motives which must have impelled men by degrees to the production of a genuine alphabet.

There are obvious deficiencies even in the most highly developed hieroglyphics. In the first place, they must have been excessively burdensome to the memory. They speedily lost their original form, which was in most cases too cumbrous to be retained when writing became frequent; their pictorial value was therefore lost, and the new form could not generally have been intelligible to a learner, who was thus obliged to acquire by memory an enormous number of symbols, compared with which even the Sanskrit alphabet may be regarded as easy. Secondly, it is impossible by hieroglyphics to express grammatical relations; the order, indeed, in which the symbols are placed may denote the distinction between subject and object; plurality may be expressed by the repetition of a symbol; some even of the relations in space, denote in more advanced languages by cases, may be pictorially rendered; but all these helps do not go far to remedy this obvious want. Experience, however, shows how much inconvenience a nation will undergo rather than make any radical change in its phonetic system. We have only to look at our own alphabet, with its numerous and universally confessed deficiencies and redundancies, and then remember the fruitless attempts which have been made to work a reform in it, to be convinced that no people will of its own accord strike out a thoroughly new system of writing. Such revolutions can only be produced by the meeting of two different civilisations, and the reception by the one of the arts and ideas of the other. But such a meeting may, and more commonly does, only stimulate the inferior race to some partial development. For the new ideas new names are required; these may be metaphorically represented out of the old vocabulary, as when the Romans called the unknown elephant the Lucanian ox, and of course wrote it so. But suppose the inferior people to be one which has not yet advanced beyond hieroglyphic writing; their simplest and most obvious plan will be to take the strange name, and express it by those symbols out of their old stock which denote the nearest sounds to that of the name required. Such symbols then cease to represent ideas only, as they used to do; they are conscientiously employed to represent mere sounds, and thus arise the first beginnings of phonetism.

Many circumstances combine to render it difficult for a nation to reach of itself pure phonetism in writing. There is strong disinclination to change, of which we have before spoken. It is always easier to put up with difficulties to which we have been accustomed all our life than to make any radical change, especially when that change causes at once serious difficulties at every moment. It was easier for the Egyptians to retain the odd mixture of ideographic, syllabic, and alphabetic writing, and occasionally to add some new key for unloading the difficulties to the formidable list which was

already in use. The ingenuity of these grammatical devices almost surpasses belief. We can only refer the curious to the hieroglyphic grammar in the fifth volume of Bunsen's *Egypt's Place in Universal History*. In the second place, a good deal must be allowed to the restraining influence of religion. It is well known that most of the ancient nations ascribed a divine origin to their systems of writing. It might well seem to them to be too wonderful a thing for the result of human ingenuity. Thus in one of the Assyrian lists of the different values of syllables, published, as has been already mentioned, by royal authority, Sardanapalus V. states that the god Nebo has revealed to the kings, his ancestors, the cuneiform writing, which he thus endeavors to simplify for the better understanding of his people (Oppert, ii. 53). The Sanskrit character, which is now known to be due to a Phœnician source, was called *Devandart*, "belonging to the city of the gods," unless, as Prof. M. Müller suggests (*Sanskrit Grammar*, p. 1), we are to understand by the gods here only the Brahmins; but whatever the name may mean, their belief in its divine origin is certain enough. And M. Lenormant points out (i. 80) that the native Egyptian term for writing meant "writing heavenly words." Now it is clear that no nation among which this belief lingered in any degree would be likely to alter fundamentally the spirit of their system of writing. Lastly, it is possible, though not very probable, that the obscurities of the existing system may have recommended it to the priests. These reasons may suffice to show that it was not in Egypt that we should expect to find the development of a purely phonetic system. But just as the Japanese took the Chinese characters, and gave them a development which they have never had in the land of their creation—just as the people of Susiana took the cuneiform writing and made it purely phonetic, without any remnant of ideography—so the work of extracting order out of the chaos of Egyptian writing was reserved for the Phœnicians.

The Phœnicians were peculiarly fitted to perform this inestimable part in the history of human development. An active and enterprising nation, they were early brought into commercial relations with Egypt, and must of necessity have learnt something of their system of writing; they could see its advantages and its perfectly remediable faults; the advantage of one definite symbol for one sound, and the disadvantage of a dozen; the desirability that this symbol should signify that sound only, and the undesirability of its denoting a horse or a man as well. And the religious scruples which may have affected the Egyptians need have no weight for strangers. If the characters were divine for the priests of Isis, they were a convenient instrument to supply every-day wants for the sailors of Tyre.

These considerations do not, however, amount to a proof that the Phœnician alphabet was derived from Egypt. It is of course possible that it disengaged itself by degrees out of an earlier hieroglyphic system at home. But of such a system no vestiges remain; and the correspondence between the Phœnician characters and those of the earlier Egyptian hieratic is sufficiently striking to warrant us in regarding it as at least provisionally true that what was natural and perfectly possible did actually take place. The general testimony of the early Greek and Roman writers, that the alphabet was invented in Phœnicia, must then be limited to the sense in which Tacitus says that the Phœnicians had this credit—*tantum repererint, quæ acceperant*.

It cannot be known with certainty whether the Phœnicians took, together with the Egyptian symbols, the phonetic values which they had in Egypt, or

whether they totally disregarded those values, and simply assigned to the symbols the value of their own sounds at will. The first view, however, seems clearly the more probable. The Phœnicians could only become acquainted with the Egyptian symbol and sound together; the one would naturally suggest the other; and we should expect that they would first take the symbols belonging to those sounds which exactly corresponded in Egyptian and Phœnician, then the symbols of other Egyptian sounds which did not exactly correspond to their own, but which seemed in each case the most analogous to them; but that there would never be any violent rupture between the symbol and its old sound. Yet it seems quite certain that there is no connection between the names which the letters bore in Phœnicia and the original object of which the Egyptian character is the debased representation. Thus the first letter of the Phœnician alphabet (corresponding to the Hebrew *adelph*) was named from its fancied resemblance to an ox's head, the second (Hebrew *beth*) to a horse, and so on. But the symbol which strangely seemed to the Phœnicians like an ox is only the form, rapidly drawn of an eagle; *beth*, in like manner, is the quickly-drawn figure of a crane. It would seem, then, that the Phœnicians borrowed sound and symbol, but no name. They cared nothing for the history of the symbols; and when they found it convenient to have a name for each symbol they chose some object whose name began with the letter in question; and we should have said that it was totally impossible that any similarity in form between the letter and the object whose name it borrowed could have helped to give currency to the nomenclature, did we not see evidence of similar and apparently equally impossible fancies in the names of the constellations, let the origin of those names be what it may.

Such, very briefly traced, seems to have been the origin of the Phœnician alphabet, the parent of almost every alphabet, properly so-called, existing on the earth.

Greek writing in the earliest times was from right to left, following the example of Phœnicia: several specimens of this still exist. The more convenient practice of writing from left to right soon became universal. It was preceded, however, by an intermediate method, in which the direction of the lines was alternately right to left and left to right, so that it was not necessary to carry the eye back, as with us, from the end of one line to the beginning of the next.

It is quite certain that the Teutonic tribes of North-western Europe possessed characters of some sort before they received the Greek or Latin alphabets. These characters are generally called *runes*, and have been the subject of some sound scholarship and much baseless speculation. They may be divided into three main classes—the Anglo-Saxon, the German, and the Scandinavian; each of these contain a number of lists of characters, which, however, do not differ from each other more than the Greek alphabets; and there is so much likeness in the whole family that we may infer a common origin for all. The term *rune* is recognized as the name of a German letter by Venantius Fortunatus at the beginning of the seventh century, in the lines—

Barbara fraxineis pingatur rhuna tabellis;
Quodque papyrus agit, virgula plana valet.

i.e., these characters were cut on smoothed ash-boughs. The meaning of the word *rún* in Anglo-Saxon is a "secret;" and the verb *rynan*, which is derived from the same, means "to whisper"—the same verb which appears in the now disused phrase, to "round in the ear." *Rúna* denoted a magician; the word is con-

tained in the German *alruna*, the well-known designation of those prophetesses whom the German tribes venerated, which appears corrupted by Tacitus (*Germ.* c. viii.) into *aurinia*. There is sufficient evidence to show that the knowledge of these runes was confined to a small class; that they were used as magical characters, and also as means of augury. It was for this reason undoubtedly that they were generally proscribed on the introduction of Christianity; and the reception of the Latin characters by the Anglo-Saxons was regarded as important as their reception of the Christian doctrines.

It is impossible to believe that the barbarous inhabitants of the German forests should have worked out for themselves a genuine alphabet before they came into intercourse with the civilised nations of the south. When we remember the long process through which a pure alphabet was reached by the highly-developed nations which dwelt on the eastern shores of the Mediterranean, it is utterly incredible that such success should have been achieved, as it were, *per saltum*, under so much unfavorable circumstances in the West. It may be asserted with some confidence that if the runes were genuine alphabets (which there seems no reason to deny), they must have been derived from the Phœnicians in process of commerce. There is quite sufficient similarity in several of the characters to make this view antecedently probable, but any historical proof would be extremely difficult, if not impossible. It is true that even where the characters resemble the Phœnician the names of the letters differ altogether; but this, as we have before seen in the case of the Phœnicians themselves, is nowise unnatural when an alphabet is borrowed; the form is important, the name signifies little, and new names are attached according to the fancy of the borrowers. It is highly probable, both from the meaning of the word *rune* itself and from the evidence of foreign writers, that these symbols were not used by their owners for any of the ordinary ends of an alphabet (except, perhaps, for inscriptions) until the Teutonic nations came into contact with Greek and Roman civilisation; by the mass of the people they were probably looked on simply as charms, the unknown symbols of an occult science. Nay, it might be held that even to the initiated they had merely a sort of hieroglyphic value, and were developed into phonetic significance only by the contact of the Greek and Roman alphabets. For this view, indeed, there is no evidence, and it is not in itself probable. But we should be driven to it if we were to suppose that the runes were the creation of the Teutonic intellect.

These ancient characters occur plentifully on memorial stones, rings, coins, &c., in Scandinavia. In England they have been found principally in Northumbria, Mercia, and East Anglia. It has been suggested (by Mr. Haigh) that this may be due to the milder principles of the Irish monks, who restored Christianity to the north of England after its fall with Edwin in 633, and did not pursue that system of eradicating every trace of paganism which had been originally commanded by Gregory. Runic writing was even employed in the service of Christianity. Mr. Kemble (*Archæologia*, vol. xviii. p. 349) interpreted with great ingenuity the mutilated inscription on the famous cross discovered at Ruthwell, and showed that it refers to the Crucifixion. But the Anglo-Saxon alphabet was soon—early in the 7th century—conformed on the Latin type, those letters of the older form alone being retained which were required to denote sounds that had no counterparts in Latin; these were *ρ* (*wén*), and *β* (*thorn*), the latter of which expresses the surd breathing in "*thin*:" in order to express the corresponding sonant (heard in "*that*," and confusedly denoted by the same compound *th*) a stroke was drawn

across the simple d (δ), and the new letter was called *edh*. The symbol ξ is sometimes found instead of y . Curious admixtures of runes with Latin characters occasionally occur even to late times. Thus, in the *Codex Exoniensis* (p. 400, ed. Thorpe), an enigma occurs in verse, and the parts apparent of the subject to be guessed are written in runes; the odd effect is increased by these runes being written in the regular way — (sometimes they were written *βουστροφιδόν*) — from right to left, contrary to the general run of the words. Kemble, in the *Archæologia*, has given an interesting translation of an Anglo-Saxon poem, each stanza of which begins with the name of a runic letter; thus the first stanza begins with Fesh, “money,” the name of f , the first runic letter, and goes on to say —

“Money is a consolation
To every man:
Yet shall every man
Liberally distribute it;
If he will that, before God,
Honor shall fall to his lot.”

The second stanza is dedicated to the bull, Ur (u), the third to thorn (th), &c. This poem accordingly gives the order of the alphabet, which agrees in the main with that of all other runic alphabets. Yet the poem is not old, for the name of s (Sigel, “the sun”) is treated by the writer as though it had been Segel “a sail” — clearly a mistake of a later time, when the true name had passed out of use. It may be added that the names of this alphabet are sometimes strangely abstract; thus we find “gift,” “hope,” “need,” “war,” which differ much from the very concrete objects which the Phenicians chose to denote their letters. In consequence of all these old alphabets beginning with the letters f , u , th , o , r , c , in the same order, the alphabets are called by some antiquarians “futhors,” just as we commonly speak of the ordinary alphabet as the A, B, C.

The doctrines of Christianity were first presented to a Teutonic people in a written form by Ulfilas, who, though not the first successful missionary to the Goths, has thereby established his claim to be regarded as the apostle of his race; and while the main body of the Goths, spurning the weak control of Rome, poured westward in their fierce career of victory towards Italy and Spain, a remnant was left in Mæsia, to whom Ulfilas gave the gospel in their own tongue. This was at the end of the 4th century of our era. He employed an alphabet of twenty-four or twenty-five letters, some of which are unmistakably Greek in form; others are common (or nearly so) to the Greek and the runic alphabets, and may therefore have been derived from either; but if they were runic, they at least received a more rounded form, it being no longer necessary to retain those angles which (as we saw above in describing the cuneiform characters) were most convenient in days when writing meant cutting on stone or wood. But some of the letters seem to be beyond doubt runic; most clearly so are f , r , u , y , and the symbol for the compound sound kw ; and the reason for all these (except r) appears to be the lack of a proper equivalent in Greek. The letter which Ulfilas adopted to denote the surd breath th is not runic, so that the Gothic and Anglo-Saxon alphabets here differ: it is apparently the Greek ϕ . It would seem, therefore, that this letter still denoted an aspirate (ϕ^h) in Greek, and not a breath, otherwise it would surely have been taken for f ; here, on the contrary, it seems to have been selected at random from a list of symbols which denoted no corresponding sounds in Gothic. On the same lack of principle (ϕ) was taken to denote hw . X was the exponent of the breath $c\tilde{a}$, as heard in German words; here the difference between the

true aspirate and the breath is not great. Long o formed a symbol which is very like *omega*.

Another alphabet which has had an important influence on Europe, and which may be destined to yet wider extension as the alphabet (in a modified form) of the great and progressive Russian empire, is the Cyrillic. This was the work of Cyril, a monk of Constantinople, who, together with Methodius preached the gospel among the Slavonic tribes of Bulgaria and Moravia, in the 9th century, long after the Teutons had come under the influence of Christianity. Cyril held the services of the church among his new converts in the vulgar tongue, into which he also translated certain books of Scriptures. The alphabet which he employed for this purpose is more thoroughly Greek than that of Ulfilas; but since the Greek alphabet was not nearly sufficient to express all the Slavonic sounds — especially the numerous sibilants — he added further signs, the history of which is not clear. This alphabet has been largely adopted by the eastern branches of the Slavonic race, including the Russians, Bulgarians, and the Illyrian division of the Slaves. The old Bulgarian (commonly called the Ecclesiastical Slavonic) is the language into which Cyril translated the Scriptures; in philology it holds the same rank as the Gothic has among the Teutonic languages: it is the parent, however, only of one of the least important dialects, the modern Bulgarian. The Illyrian family is divided into the Servians on the one hand, and the Croats and Slovenian peoples on the other. These parties are separated by difference of religion; the Servians belong mainly to the Greek Church, while the others are exclusively Roman Catholic; and the members of the Greek Church naturally cling to the Cyrillic characters, while the Catholics have adopted the Latin alphabet. It is not easy to predict which characters will ultimately predominate. The Latin letters are insufficient to express the Slavonic sounds; but this deficiency can be eked out by critical signs, and the greatest literary activity is shown by the Latinising party. Lastly, the Cyrillic alphabet has been adopted by the Wallachians, through the influence of their Slavonic neighbors, though it is little adapted to express their essentially Latin speech, derived from the colonists whom Trajan settled in the new Roman province of Dacia. Most of the needless symbols have been dropped in the newest form of Wallachian alphabet.

Cyril's original alphabet consisted of forty-eight symbols, but some of these are slightly different representations of the same sound; others are tachygraphics for combinations of sounds as *sh*, *ts*, &c. The names were not Greek, with the exception of three — *kst*, *psi*, and *thita* — which were relegated to the end as unnecessary, but they retained their original Greek place as numerical signs. On examination of the alphabet in its published form, it will be seen that B occupies the third place, while a modified B stands second: the reason is, that B had come to denote the v sound in Greek, and therefore carried this value into the Slavonic. The modified letter denotes the old b sound. The 7th letter which is not Greek, had the sound of English soft j , a little softer than the French j in *jamais*. The 8th and 9th symbols are the Greek s and z : they are supposed to have had the same sound, that of the soft English z (not dz) — perhaps one of them may have originally denoted dz , a sound which easily passes into dj ; dj had a special symbol both in the Servian and Wallachian, though it had none in the Cyrillic, probably because the sound had not then been produced; if it had, we may conclude, from the exactness which the Cyrillic alphabet everywhere shows, that it would not have been left without a mark. The 8th letter has been expelled

from the Russian alphabet as superfluous: the Russians have no *dj* sound. The 10th and 11th letters were sounded alike as *i*; the 10th is the Greek *Eta*, which had therefore become undistinguishable from Iota in Cyril's day, as it is in modern Greek. The 12th letter, *I* pure and simple, denoted the semi-vowel *y*. The 22d was *t*, followed by a parastic *y*. The 23d and 24th are only different ways of writing the same combination *ou*; the Greeks having changed the *u* sound into *ii*, Cyril was obliged to write *ou* for *u*, as the Greeks themselves did. The Russian has one symbol (*y*) to denote this sound: it is probably a tachygraphy of the 24th. The 25th and 26th denoted respectively the breathings *f* and German *ch*. We may recall here the different treatment of *φ* by Ulfilas; it seems a fair inference that the sound of *φ* had changed from an aspirate to a breathing between the times of Ulfilas and Cyril. The 27th and 28th are the Greek Omega in the simple and in a modified form: they denoted the sounds heard in *note* and *not* respectively; these have been dropped in all the derived alphabets, in which the 17th letter does work for both.

ALPHEUS, the chief river of Peloponnesus, now called *Rufia* or *Rouphi*. Its sources are in the mountains of Arcadia, to the east of Megalopolis. Being fed by a great number of small streams, it becomes navigable, and, traversing Elis, empties itself into the Ionian sea.

ALPHONSO, ALFONSO, ALONZO, AFFONSO, or IL-DEFONSO. This name, so famous in the annals of the Iberian peninsula, has been borne by no fewer than twenty-two of its sovereigns—viz., by ten of the Asturias and Leon, one of Castile when separate from Leon, five of Aragon, and six of Portugal.

1st, Asturias and Leon.—**ALPHONSO I.**, surnamed "The Catholic," King of the Asturias, the son of Pedro, duke of Biscay, was born in the year 693. On the death of Favila, the son of Pelayo, Alphonso, who had married Ormisinda, the daughter of the latter, was proclaimed king of Asturias. Alphonso died at Cangas in 737, and was succeeded by his son Fruela I.

ALPHONSO II., surnamed "The Chaste," King of the Asturias, the son of Fruela I., was but a child when his father was assassinated in 768, and consequently his claims to the throne were passed over in favor of Aurelio, who was probably a cousin of Fruela. Alphonso was invested with regal authority by Silo, the successor of Aurelio; on whose death, in 783, he became sole ruler. He was afterward dethroned by his uncle Mauregato, retired into Biscay, and died in 843.

ALPHONSO III., surnamed "The Great," King of the Asturias, was born in the year 848, and succeeded his father, Ordonio I., in 866. In the following year, Fruela, count of Galacia, disputed Alphonso's right of succession, and forced him to retire to Alava; but Fruela's tyranny so exasperated the people that he was assassinated before he was a year in power, and they gladly recalled Alphonso to the throne. He died toward the end of the year 901. He was the last monarch who bore the title King of Asturias, his successors being called kings of Leon, from the new capital of the kingdom.

ALPHONSO IV., "The Monk," King of Leon, succeeded Fruela II., his uncle in 924. On the death of his wife, about six years afterwards, he resigned his crown to his brother Ramiro, and retired into a cloister; but soon growing weary of monastic life, he made an attempt to resume the sceptre. He was, however, taken prisoner at Leon, and confined in the monastery of St. Julien, where he died, probably about two and a half years after.

ALPHONSO V. succeeded his father Bermudo II. in 999, being then about five years of age. Gonzalez,

count of Galacia, and his wife, were, by appointment of Bermudo II., guardians of the young king; and on arriving at manhood he married their daughter Elvira. The regency is remarkable for the defeat and death of the famous Moor Almansur in 1002. Alphonso died at Visco in 1028.

ALPHONSO VI. of Leon, and eventually I. of Castile, surnamed "The Valiant," was born in the year 1030. His father, Fernando the Great, who in his own right was king of Castile only, but succeeded to the throne of Leon in right of his wife, died in 1065, leaving his kingdom divided among his children. Sancho, the eldest son, received as his portion, Castile; to Alphonso was given the kingdom of Leon, the territory of Campos, part of Asturias, and some towns in Galicia; and Garcia the youngest brother, received a part of Galicia and of Portugal; while the towns of Toro and Zamora were left to Urraca and Elvira, Fernando's two daughters. Peace was not long maintained between the three brothers. In 1068 Sancho made war upon Alphonso, and defeated him in a bloody battle at Piantica, on the Pisuerga. In 1071, hostilities, which seem to have been suspended, again commenced, and Alphonso having recruited his army, defeated Sancho at a place called Valpelle, on the banks of the Carrion; but the latter, being reinforced, it is said by the famous Rodrigo Diaz de Bivar, commonly called "The Cid," made an attack during the night, and almost exterminated the Leonnese army, Alphonso himself being taken prisoner. He was compelled to abdicate his throne, and was imprisoned in the monastery of Sahagun, probably with the intention of making him become a monk; but escaping from this place of confinement, he sought refuge with Almamun, the Moorish king of Toledo, who received him with great hospitality. In 1108 the Almoravides made another serious attempt to destroy the power of Alphonso. A bloody battle was fought at Uclès, in which the Leonnese army was completely defeated, and Sancho, Alphonso's only son, who commanded in place of his father, slain. Alphonso died at Toledo in 1109, and was succeeded by his daughter Urraca, whose husband, Alphonso I. of Aragon, is by some historians enumerated among the kings of Leon as Alphonso VII.

ALPHONSO VII. the same as **ALPHONSO I.** of Aragon (*q.v.*)

ALPHONSO VIII. of Leon (or VII., according to those who do not consider Alphonso of Aragon as properly a king of Leon) and II. (or III.) of Castile, often called Alphonso Raymond and "The Emperor," was born in the year 1106. He was the son of Urraca, daughter of Alphonso VI., and Raymond of Burgundy, her first husband. In 1112 he was proclaimed king of Galicia, by whom it does not clearly appear; in 1122 he was associated with his mother in the government of Leon and Castile; and on her death in 1126 he became sole monarch. He died in 1157 at Tremada, on his return from an indecisive battle with Cid Yussuf at Jaen; and was succeeded by his elder son, Sancho, in the throne of Castile, and by his younger, Fernando, in that of Leon. In 1156 he instituted the order of St. Julien, afterwards so celebrated under the name **ALCANTARA** (*q.v.*)

ALPHONSO IX. (VIII.), King of Leon only, succeeded his father Fernando in 1188. In 1190 he sought to strengthen his position by marrying his cousin Teresa of Portugal. In 1217, Fernando, the eldest son of Alphonso and Berengaria, became king of Castile. Alphonso, thinking that his own claims had been unjustly passed over, declared war upon his son; but finding that the people preferred Fernando, he relinquished his claims. The remainder of Alphonso's reign was chiefly spent in campaigns against the Moors. Along with his son, he captured Merida, Badajoz, and other cities; and in 1230

gained a brilliant victory over Mahommed Ibn Hud at Merida. He died in the same year, and was succeeded by his son Fernando, who thus finally united the kingdoms of Leon and Castile.

ALPHONSO X., surnamed *El Sabio*, or "The Wise," King of Leon and Castile, was born in 1221, and succeeded his father Fernando III. in 1252. He ascended the throne with the entire approbation of his subjects, and with every prospect of a happy reign: but, through the ill-directed aims of his ambition, few sovereigns have been more unfortunate. Alphonso died on 4th April 1284. He was a learned prince, and a great encourager of learning, brave and energetic, but at the same time restless and ambitious. He has been charged with impiety, chiefly on account of a well-known saying of his, that "had he been present at the creation, he could have given some useful hints for the better ordering of the universe." To him science is indebted for a set of astronomical observations known as the *Alphonsine Tables*, which were drawn up under his auspices by the best astronomers of the age; and in the palace of Segovia a room is still shown as the observatory of Alphonso. He was also distinguished as a poet and as a legislator. In the Escorial is preserved a curious manuscript containing some hymns of his composition; and he was the principal compiler of a code of laws which is still extant under the name of *Las Siete Partidas*.

ALPHONSO XI., "The Avenger," was an infant when he succeeded his father, Ferdinand IV., in 1312. During his long minority the kingdom was cruelly distracted by intestine warfare. Assuming the reins of government in 1324, he strove to repress the turbulent spirit of the nobility, and to put down that system of brigandage to which it had given rise, acquiring by his inflexible severity the title of "The Avenger." He died of the plague on the 26th of March 1350, aged 40.

2d, *Castile*. — ALPHONSO III. (according to other enumerations, VIII. or IX.), surnamed "The Noble," is the only king of Castile of the name who was not also king of Leon. He was born in 1155, and succeeded his father, Sancho III., in 1158. Alphonso died at Garci Muños in 1214, and was succeeded by his son, Enrique I. Alphonso was a patron of literature, and in 1208 founded a university at Valencia, the first in Christian Spain. This university was afterward transferred to Salamanca.

3d, *Aragon*. — ALPHONSO I., surnamed *El Batallador*, "The Fighter," King of Navarre and Aragon, was the second son of Don Sancho Ramirez, and succeeded his brother, Pedro I., in 1104. By his marriage in 1109, with Urraca, daughter and heiress of Alphonso IV., of Leon and Castile, he became her associate in the government of these kingdoms, and in the same year assumed the title of "Emperor of all Spain." Misunderstandings soon arose between Alphonso and his wife, and he separated from her shortly after their marriage, an act which was confirmed by the council of Palencia in 1114. Alphonso, however, refused to give up his claims to the kingdoms of Leon and Castile, and maintained a constant struggle with Urraca till her death, in 1126. Alphonso crossed the Pyrenees, and captured the cities of Bordeaux in 1130, and Bayonne in 1131. On his return to Spain, he took Mequinenza from the Moors in 1133, and invested Fraga in 1134, where, during a sally from the town, he received a wound from which he died a few days after.

ALPHONSO II. was born in 1152, and in 1163 succeeded his father, Ramonido V., as count of Barcelona, his mother, Petronilla, daughter of Ramiro II., king of Aragon, at the same time resigning that kingdom to him. He died in 1196.

ALPHONSO III., the son of Pedro III., was born in

1265, and in 1285, on the death of his father, being absent in Majorca on an expedition against his uncle Jayme, assumed the title of king without taking the oaths of adherence to the articles to which his predecessors had subscribed. He died in 1291.

ALPHONSO IV., son of Jayme II., was born in 1299, and ascended the throne in 1327. He died in 1336.

ALPHONSO V. of Aragon, I. of Sicily and Sardinia, and latterly I. of Naples, was born in 1385, and succeeded his father, Fernando the Just, as king of Aragon and of Sicily and Sardinia, in 1416. In 1420 Joanna I. of Naples offered to make Alphonso her successor if he would assist her against Louis of Anjou. This he did, but, owing to misunderstandings, the queen revoked her adoption of Alphonso in 1423, making Louis of Anjou her heir. Recalled to Spain immediately after by an attack made by the Castilians upon his hereditary kingdom, he left his brother Pedro as his lieutenant at Naples, which he had taken by storm the year before. On his way to Spain he captured, but generously refrained from pillaging, Marseilles, a city belonging to his rival the duke of Anjou. He laid siege to Naples, and after an obstinate resistance captured it in 1442. The States-General were then convoked, and solemnly proclaimed Alphonso king; his election being sanctioned by Pope Eugenius IV., who had previously promised that honor to René. Alphonso now fixed his residence at Naples, and devoted himself chiefly to the improvement of his kingdom; although he was also frequently involved in the late wars and disputes of the Italian princes. He died at Naples, on the 27th June 1458; and was succeeded in his kingdoms of Aragon and of Sicily and Sardinia by his brother John, and in that of Naples by his natural son Ferdinand.

4th, *Portugal*. — ALPHONSO I., *Enriquez*, son of Henry of Burgundy, count of Portugal, and Teresa of Castile, was born at Guimaraens in 1094. He succeeded his father in 1112, and was placed under the tutelage of his mother. When he came of age he was obliged to wrest from her by force that power which her vices and incapacity had rendered disastrous to the state. Being proclaimed sole ruler of Portugal in 1128, he defeated his mother's troops near Guimaraens, making her at the same time his prisoner. He also vanquished Alphonso Raymond of Castile, his mother's ally, and thus freed Portugal from dependence on the crown of Leon. He died in 1185. Alphonso was a man of gigantic stature, being 7 feet high according to some authors. He has long been regarded as a saint by the Portuguese, who reverence him both on account of his personal character and as the founder of their kingdom.

ALPHONSO II., "The Fat," was born in 1185, and succeeded his father, Sancho I., in 1211. He was engaged in war with the Moors, gained a victory over them at Alcazar do Sal in 1217, and died in 1223.

ALPHONSO III., son of Alphonso II., was born in 1210, and succeeded his brother, Sancho II., in 1248. Alphonso died in 1279.

ALPHONSO IV. was born in 1290, and in 1325 succeeded his father, Dionis, whose death he had hastened by his intrigues and rebellions. Alphonso died almost immediately after, on the 12th May 1357.

ALPHONSO V., *Africano*, was born in 1432, and succeeded his father Edward in 1438. During his minority he was placed under the regency, first of his mother, and latterly of his uncle, Don Pedro. In 1448 he assumed the reins of government, and at the same time married his cousin Isabella, daughter of Don Pedro. In the following year, being led by what he afterwards discovered to be false representations, he declared Don Pedro a rebel, and defeated his army in a battle at Alfarrobeira,

in which his uncle was slain. In 1458, and with more numerous forces in 1471, he invaded the territories of the Moors in Africa, and by his successes there acquired his surname of "The African." He died in 1481.

ALPHONSO VI., the second king of the house of Braganza, was born in 1643, and succeeded his father in 1656. Alphonso died at Cintra in 1675.

ALPHONSUS A SANCTA MARIA, or ALPHONSO DE CARTAGENA, a celebrated Spanish historian, was born at Carthagena in 1396, and died on the 12th July 1456.

ALPINI, PROSPERO (in Latin *Prosper Alpinus*), a celebrated physician and botanist, was born at Marostica, in the republic of Venice, on the 23d November 1553. In the course of his studies he had paid particular attention to botanical science; but the sphere of his practice was too limited to afford him much opportunity of prosecuting his favorite study. He wished particularly to extend his knowledge of exotic plants, by observing their economy and habits in their native soil. To gratify this laudable curiosity an opportunity presented itself when George Emo or Hemi, the consul for the Venetian republic in Egypt, appointed Alpinus his physician. His treatise *De Medicina Ægyptiorum* contains the first account of the coffee-plant that was published in Europe. He died of slow fever on the 6th February 1617, in the sixty-fourth year of his age, and was succeeded as botanical professor by one of his sons. The genus *Alpinia*, belonging to the order Zingiberaceæ, is named after him. Alpinus wrote the following works in Latin:—1. *De Medicina Ægyptiorum, Libri iv.*, Venice, 1591, 4to; 2. *De Plantis Ægypti Liber*, Venice, 1592, 4to; 3. *De Balsamo Dialogus*, Venice, 1592, 4to; 4. *De Prasagionibus Vita et Morte Ægrotantium, Libri vii.*, Venice, 1601, 4to; 5. *De Medicina Methodica, Libri xiii.*, Padua, 1611, folio; 6. *De Rhapontico Disputatio*, Padua, 1612, 4to. Of all these works various editions have appeared; and besides these, two posthumous treatises were published by his son—1. *De Plantis Exoticis, Libri ii.*, Venice, 1627, 4to; 2. *Historia Naturalis Ægypti, Libri iv.*, Lugd. Bat. 1635, 4to. Several other works of Alpinus remain in manuscript.

ALPS. Taking a general view of the earth's surface, the continent of Europe appears to be no more than a great peninsula extending westward from the much vaster continent of Asia. Its shores are deeply indented by two inland seas connected by narrow straits with the Atlantic Ocean, and these in their turn are divided into gulfs that penetrate still more deeply into the land, and form a number of secondary peninsulas. The Mediterranean Sea, by its branches—the Gulf of Genoa, the Adriatic and the Ægean Sea—forms the Iberian, the Italian and the Greek peninsulas; and the Baltic Sea, extending northward into the Gulf of Bothnia, forms on one side the great Scandinavian peninsula, and on the other that of Denmark. Save the last, all these peninsulas of Europe are essentially mountain regions, traversed by lofty chains that occupy a large portion of their surface. But in height and importance these are much surpassed by a great mountain zone stretching from the southeast of France to the frontiers of Hungary, and between Italy and the plains of Southern Germany, which is collectively known as the Alps, and which must be considered as the most important feature in the physical geography of the continent.

The received opinion is, that the name Alps is derived from a Celtic root—*alp* or *alb*—signifying height. This has been connected by some writers with the Latin *alb*, *albus*, white, referring to the color of the peaks. *Alp* in South Germany—*alpa* in old High German—is exclusively applied to mountain pastures. For the present the derivation must remain somewhat uncertain.

To define the precise limits of the Alps, is a some-

what arbitrary operation. To the W. they extend through a large portion of the French departments of the Savoie, Haute-Savoie, Hautes Alpes, and Basses Alpes, being divided from the mountain district of the Cevennes by the broad and deep valley through which the Rhone flows from Lyons to the Mediterranean. The Jura range, usually regarded as distinct from the Alps, is nevertheless closely connected on one side with the outer ranges of the Alps of western Savoy, and on the other with those of northern Switzerland. On the N. side the Alps are definitely bounded by the lake of Constance, the plain of Bavaria, and the low country extending from Salzburg to the neighborhood of Vienna. By these they are completely separated from the mountainous districts of central Germany, which extend through western Bohemia and Saxony in one direction to the Hartz mountains, and in the other to the Sudeten, or Riesengebirge, of Silesia. Hence it happens that the drainage of the northern slopes of the Alps flows either to the North Sea through the Rhine, or is diverted through the Danube to the Black Sea, and no portion of it reaches the Baltic. The eastern limit of the Alps is not easily defined with accuracy. The region of high hills, chiefly formed of tertiary strata, that extends from the left bank of the Mur into Hungary is continued by the north side of Lake Balaton to the Danube near Buda; and some geographers see in the hilly district that stretches thence to the northern Carpathians a connection between that range and the Alps. For practical purposes it seems that the line of depression, partly formed by the valley of the Mur, through which the railway is carried from Vienna to Laybach, may be considered as the eastern boundary of the Alpine chain. On the southern side the difficulty of fixing the precise limits of the Alpine chain is still more apparent. For a distance of some 350 miles, from the neighborhood of Turin to that of Gorizia, the boundary is sufficiently obvious. The mountains subside into the continuous plain which includes the greater part of Piedmont, Lombardy, and Venetia; and their drainage is all borne eastward to the Adriatic. But on the west side of Piedmont the Alpine chain dividing Italy from France extends nearly due southward till it approaches to the Mediterranean in the neighborhood of Nice. About 40 miles north of this city, that which, from its superior height and its geological structure, we call the main chain, is bent round from west to east in a curve, slightly convex towards the south, till it becomes parallel to the Mediterranean shore, and is merged in the chain of the Apennines. For reasons hereafter mentioned it would appear that the limits of the Alps in this direction may best be fixed at the Col d'Altare, west of Savona, though the boundary commonly adopted is that of the Col di Tenda, lying considerably farther to the west. At the southeastern extremity of the Alpine chain the difficulty of fixing its limits arises rather from the vague use of geographical terms by ancient and modern writers than from the physical structure of the region. Taking no account of the arbitrary proceedings of geographers who have included in the Alps the mountains dividing Bosnia from Croatia and Dalmatia, and regarding only the natural features of the country, it seems clear that the south-eastern extremity of the Alps must be looked for in the group of lofty peaks between the head waters of the Isonzo and those of the Save, whose highest summit is the Terglou; and if we are not to include all the mountain ranges of European Turkey and Greece within the same designation, the plateau of the Karst must be held to form the boundary between these and the Alps.

Starting from the pass of Altare or Cadibona, west of Savona, the main chain extends first south-west, then

nearly due west, to the Col di Tenda, but nowhere rising beyond the zone of coniferous trees. Beyond that limit the range is more lofty, and includes four peaks exceeding 10,000 feet in height, till the line dividing the waters flowing to the Adriatic, through the Po, from the short streams that flow into the Gulf of Genoa, reaches the Mont Enchastraye. Beyond that point, although the line of watershed is very sinuous, its general direction for a distance of about 75 miles is nearly due north. On the east side the waters run to the Po; on the west they flow through the Durance to join the Rhone near Avignon. The most considerable peaks in the range immediately north of the Mont Enchastraye are the Grand Rioburent and the Aiguille de Chambeyron; but these are much surpassed by the Monte Viso, which is the highest peak in the range dividing Piedmont from Dauphiné. On the north side of Monte Viso the main chain diminishes much in average height, and presents no prominent peaks until we reach the Mont Tabor. That summit forms the apex of a salient angle which the main chain here presents on the side of France. For a distance of about 28 miles this extends eastward to the prominent peak of the Roche Melon, which may be considered as a re-entering angle in the great rampart by which Italy is guarded from her northern neighbors. Here the main chain resumes its northerly direction, and attains a greater average height than it has previously exhibited. Several of the prominent peaks in the range connecting the Roche Melon with Mont Blanc exceed 11,000 English feet in height, though they are much surpassed by the highest group of the Graian Alps, lying on the side of Piedmont, and that of the Tarentaise Alps in Savoy; while there is in this part of the main range but one considerable depression, which is that crossed by the road of the Little St. Bernard. In the range crowned by the summit of Mont Blanc the Alpine chain attains its highest elevation. From thence to the Pass of St. Gotthard its general direction varies between east and north-east. To the east of Mont Blanc a comparatively low tract allows of several comparatively easy passes between Switzerland and Piedmont, one of which has long been famous as the Pass of the Great St. Bernard; but from that to the Simplon Pass, a distance of 52 miles in a straight line, or about 75 miles if measured along the watershed, the main chain preserves a greater average height than in any other part. Several peaks lying in the dividing ridge, such as the Grand Combin, Matterhorn, Lyskamm, and Monte Rosa, exceed 14,000 feet in height; and these are rivalled by at least six summits on the north side of the same ridge, which at two points only sinks below the level of 10,000 feet. Simplon Pass corresponds to what may be called a dislocation of the main chain. From thence to the St. Gotthard the dividing ridge runs nearly due north-east, and does not present any dominant summit excepting Monte Leone. On the east and south-east side of the St. Gotthard Pass, as far as that of the Maloya, the line of watershed between the affluents of the Rhine and that of the Po is determined by what may be called accidental conditions. The chief mountain ridges, which culminate in the Cima Camadra, Piz Valrhain, and Tambohorn, instead of being arranged along the parting of the waters, lie in a transverse direction, and thence the natural frontier of Italy is here more broken and irregular than elsewhere; and it is only on the south side of the Maloya Pass that the main chain assumes a tolerably continuous direction from west-south-west to east-north-east, as between Piz Güz and the Bernina Pass it rises into the lofty group whose dominant peaks are Piz Tremoggia, Piz Bernina, and Piz Cambrena. Eastward of the Bernina Pass the same direction is preserved, and in the range including the Corno di Campo, Monte Zembrasca, and Monte Foscagno the level scarcely sinks

below 9000 feet; but beyond the last-named summit, in the space lying between the Lower Engadine, the head waters of the Adige, and those of the Adda, the semblance of a continuous ridge forming the watershed between the Inn and the Adriatic altogether disappears. If we adhere to the usage of designating as the main chain the ridges which part the waters flowing in different directions, it must be owned that the disposition of the chief mountain masses has no connection with the direction of that chain. Lying between the great mass of the Orteles Alps to the south and the considerable group of the Silvretta Alps on the north side of the Inn, the greater part of the mass in question is drained by streams that flow into the latter river; but the arrangement of the valleys seems to be largely due to erosive action. Few summits in this part of the main chain exceed 10,000 feet, the highest being Piz Scesvenna on the east side of Val Scarla.

The break in the continuity of the Alpine chain marked by the deep valley through which the main branch of the Adige descends, first southward and then eastward from its source to Meran and Botzen, is one of the most remarkable features in the orography of the Alps. The little lake which is regarded as the chief source of the river lies within less than five miles of the Inn, where that river enters the Tyrol, and no apparent barrier divides the lake from the Inn valley. Eastward of this limit the Alpine chain exhibits a degree of order in its general arrangement which it is impossible to trace in its western and central portions. For a distance of some 250 miles a broad zone of crystalline rocks extends from west to east, flanked on the north and south sides by parallel zones of sedimentary rocks, chiefly belonging to the older secondary formations. Two great valley systems on the opposite sides of the central zone closely coincide with those geological boundaries, and mark out in the physical aspect of this region the limits between the central and secondary zones. In the former are situated all the highest peaks of the eastern Alps. For a distance of about 140 miles, from the Schaffkogel, south-east of Nauders, to the Markkahrspitz, the average level of the main chain is nearly as high as in any equally long section of the central or western Alps. There is one very considerable depression which is marked by the Brenner Pass, but elsewhere in that long barrier there are but three points where the range is passable by beasts of burden. Between the two main sources of the Adige, at the Reschen Scheideck and the Brenner Pass, the considerable groups of the Oetzthal and Stubay Alps attain a great average elevation, though two points only—the Wildspitz and the Weisskugel—surpass the level of 12,000 feet. The drainage of these groups is mostly carried to the Inn, and the line of watershed, about 53 miles in length, is much less direct than in the more easterly portion of the chain. This extends nearly due east for about 90 miles from the Brenner Pass, nowhere falling below the level of 8000 feet, and in two prominent peaks—the Gross Venediger and the Gross Glockner—rising considerably above the limit of 12,000 feet. At a point somewhat north of the Markkahrspitz the central chain divides into two parallel ranges, between which lies the upper valley of the Mur. This river flows for a distance of fully 80 miles nearly due east, till at Bruck-an-der-Mur it turns southward to approach the Drave, and ultimately joins that stream. Various reasons combine to induce geographers to regard the more northern of the two ranges above mentioned, which divides the Enns and other minor tributaries of the Danube from those of the Drave, as constituting the eastern extremity of the main chain of the Alps. This extends a little north of due east for more than 110 miles, with a comparatively low mean elevation, from

the Arlische into the Semmering Pass, which we regard as the eastern limit of the main chain of the Alps.

Measured along the watershed, as above defined, but without taking into account the minor sinuosities, which would considerably increase the total, the length of the main chain is about 790 English miles.

For ages before there existed any correct knowledge of the configuration of the Alpine chain, the needs of war and commerce had urged the people dwelling on the opposite sides of the great barrier to seek out the easiest and most direct routes for traversing it. Hence the chief passes of the Alps have been known and frequented from a period antecedent to authentic history, while, until a quite modern period, little attention was given to the parts of the chain which did not lie in or near the lines of traffic. It is highly probable that many other passes, affording the easiest means of communication between adjacent valleys, have been known and used by the native population from a very remote period, but only those which served for international purposes of war or peace became known at a distance, and are alluded to by ancient writers. A pass is a depression between two adjacent mountains, and the track is usually carried over the lowest part of that depression; but nevertheless nearly all the passes of the Alps involve a long ascent to reach the summit, and a long descent upon the opposite slopes. Hence the Romans, who were the first semi-civilized people to make extensive use of the Alpine passes, applied to each of them the term *Mons*. The same names, more or less modified in the middle ages, have been preserved in the dialects of Latin origin that prevail throughout the western half of the Alpine chain, and the modern name for the chief passes are still Mont Genève, Mont Cenis, Mont Iséran, Petit Mont St. Bernard, Grand Mont St. Bernard, Monte Moro, and Monte San Gottardo. In more recent times, since geographers have attempted to fix the names and positions of the chief summits of the Alps, they have been continually misled by the supposition that a name of high antiquity designating a mountain must belong to some prominent peak. The errors arising from that source have not yet disappeared from geographical works of high repute, but in point of fact each of the names above enumerated belongs solely to the pass, and there is no neighboring peak entitled to the same designation. The more important passes of the Alps are enumerated in the following description of the chief groups of the Alps; but it may be here remarked that the direction of the main routes for traffic is not exclusively determined by the position of the lowest and easiest passes over the main chain. The configuration of the mountains is such that a traveller proceeding from Italy to France, Switzerland, or Germany, after crossing a comparatively easy pass over the main chain, may find it necessary to traverse a second and loftier pass over a lateral chain, or else follow a circuitous route that may double the length of his journey. Thus a traveller going from Turin to Lyons, who should take what appears to be the direct course over the pass of Mont Genève, the easiest in the whole range of the western Alps, will find, on descending to Briançon, that he must cross the much higher and more difficult pass of the Col de Lautaret, or else descend along the Durance till it emerges into the lower country near Gap, and thus more than double the length of his journey. Including the Semmering Pass, there are now not less than 60 Alpine passes that are traversed by carriage roads; and besides three lines of railway now open for traffic, several others are in course of construction.

Actual observation of the Alpine region through the greater part of its extent, or even the careful study of accurate models, must convince any one who seeks to

divide it into groups that it is not possible to do this by adhering rigidly to any single test or rule. In a general way, it is natural and desirable to include under the same name mountain masses that are not divided by a broad and deep opening; but it is sometimes more convenient to include in one group disjointed masses that have some natural connection with each other, rather than multiply groups to an inconvenient extent. In some cases the geological structure may supply a rational ground for preferring one arrangement to another, when the choice would otherwise be arbitrary; and in a few cases it may be well to yield something to ancient usage, based upon political or ethnological grounds. Accurate knowledge of the Alps is so recent that few attempts have been made to establish a general division of the entire region, and it cannot be said that any one arrangement has obtained such general recognition as not to be open to future modification; but there is a pretty general agreement as to the main features of that here proposed, to which a few general remarks must be premised.

Whatever may have been the original cause of those disturbances of the earth's crust to which great mountain chains owe their existence, it is generally, though not universally, true that the higher masses (formed of rocks geologically more ancient) are found towards the central part, and that these are flanked by lower ranges, composed of more recent rocks, which surround the central groups very much as an outer line of entrenchment may be seen to surround a fort. In most cases it is not possible to descend continuously in a nearly direct line from the crest of a great mountain chain to the plains on either side, for there are usually intermediate valleys, running more or less parallel to the central range, which separate this from outer secondary ranges. These, in their turn, are often accompanied by external ranges, intermediate between them and the plains, and related to them as they are to the central ranges. The type of arrangement here described is more or less traceable throughout the greater part of the Alps, but is most distinctly exhibited in the eastern portion lying between the Adige and the frontier of Hungary. We have a central range, composed mainly of crystalline rock; a northern range, formed of secondary rocks, separated from the first by the great valleys of the Inn, the Salza, and the Enns; a southern range, somewhat similar to the last in geological structure, divided from the central one by the Rienz, or east branch of the Adige, and the Drave. Flanking the whole, as an external entrenchment on the north side, are the outer ranges of the Bavarian Alps, of the Salzkammergut, and of Upper Austria, to which correspond on the south side the Monti Lessini, near Verona, the mountains of Recoaro, those of the Sette Comuni, and the considerable masses crowned by the summits of the Grappa, the Col Vicentino, the Monte Cavallo, the Monte Matajur, and Monte Nanos. Where, as in the cases above mentioned, the secondary ranges of the Alps rise to a greater altitude, and are completely separated from the neighboring portions of the central chain, it is impossible not to distinguish them as distinct groups; but the outermost ranges, which rarely rise above the forest zone, and are in all cases regarded as appendages of the adjoining groups. The outer ranges are called in German *Voralpen*, and in Italian *Prealpi*, and it is to be desired that equivalents should be introduced in other European languages.

It is well known that as we rise from the sea-level into the upper regions of the atmosphere the temperature decreases. The effect of mountain chains on prevailing winds is to carry warm air belonging to the lower region into an upper zone, where it expands in volume at the cost of a proportionate loss of heat, often accompanied

by the precipitation of moisture in the form of snow or rain. The position of the Alps about the centre of the European continent has profoundly modified the climate of all the surrounding regions. The accumulation of vast masses of snow, which have gradually been converted into permanent glaciers, maintains a gradation of very different climates within the narrow space that intervenes between the foot of the mountains and their upper ridges; it cools the breezes that are wafted to the plains on either side, but its most important function is to regulate the water supply of that large region which is traversed by the streams of the Alps. Nearly all the moisture that is precipitated during six or seven months is stored up in the form of snow, and gradually diffused in the course of the succeeding summer; and even in the hottest and driest seasons the reserves accumulated during a long preceding period of years in the form of glaciers are available to maintain the regular flow of the greater streams. Nor is this all; the lakes that fill several of the main valleys on the southern side of the Alps are somewhat above the level of the plains of Lombardy and Venetia, and afford an inexhaustible supply, which, from a remote period, has been used for that system of irrigation to which they owe their proverbial fertility. Six regions or zones, which are best distinguished by their characteristic vegetation, are found in the Alps. It has been a common error to suppose that these are indicated by absolute height above the sea-level. Local conditions of exposure to the sun, protection from cold winds, or the reverse, are of primary importance in determining the climate and the corresponding vegetation.

1. *Olive Region.*—The great plain of Upper Italy has a winter climate colder than that of the British Islands. The olive and the characteristic shrubs of the northern coasts of the Mediterranean do not thrive in the open air, but the former valuable tree ripens its fruit in sheltered places at the foot of the mountains, and penetrates along the deeper valleys and the shores of the Italian lakes. The evergreen oak is wild on the rocks about the lake of Garda; and lemons are cultivated on a large scale, with partial protection in winter.

2. *Vine Region.*—The vine is far more tolerant of cold than the olive, but to produce tolerable wine it demands, at the season of ripening, a degree of heat not much less than that needed by the more delicate tree. These conditions are satisfied in the deeper valleys of the Alps, even in the interior of the chain, and up to a considerable height on slopes exposed to the sun. The protection afforded by winter snow enables the plant to resist severe and prolonged frosts, such as would be fatal in more exposed situations.

3. *Mountain Region, or Region of Deciduous Trees.*—Many writers take the growth of corn as the characteristic of this region; but so many varieties of all the common species are in cultivation, and these have such different climatal requirements, that they do not afford a satisfactory criterion. A more natural limit is afforded by the presence of the chief deciduous trees—oak, beech, ash, and sycamore. These do not reach exactly to the same elevation, nor are they often found growing together; but their upper limit corresponds accurately enough to change from a temperate to a colder climate that is further proved by a change in the wild herbaceous vegetation. This limit usually lies about 4000 feet above the sea on the north side of the Alps, but on the southern slopes it often rises to 5000 feet, sometimes even to 5500 feet. It must not be supposed that this region is always marked by the presence of the characteristic trees. The interference of man has in many districts almost extirpated them, and, excepting the beech forests of the Austrian Alps, a con-

siderable wood of deciduous trees is scarcely anywhere to be found. In many districts where such woods once existed, their place has been occupied by the pine and Scotch fir, which suffer less from the ravages of goats, the worst enemies of tree vegetation.

4. *Subalpine Region, or Region of Coniferous Trees.*—This is the region which mainly determines the manner of life of the population of the Alps. On a rough estimate, we may reckon that, of the space lying between the summits of the Alps and the low country on either side, one-quarter is available for cultivation, of which about one-half may be vineyards and corn-fields, and the remainder produces forage and grass. About another quarter is utterly barren, consisting of snow-fields, glaciers, bare rock, lakes, and the beds of streams; and there remains about one-half, which is divided between forest and pasture, and it is the produce of this which mainly supports the relatively large population. For nearly half the year the flocks and herds are fed on the upper pastures; but the true limit of the wealth of a district is the number of animals that can be supported during the long winter, and while one part of the population is engaged in tending the beasts, and in making cheese and butter, the remainder is busy cutting hay and storing up winter food. The larger villages are mostly in the mountain region, but in many parts of the Alps the villages stand in the subalpine region at heights varying from 4000 to 5500 feet above the sea, more rarely extending to about 6000 feet. The most characteristic feature of this region is the prevalence of coniferous trees, which, where they have not been artificially reduced, form vast forests that cover a large part of the surface. These play a most important part in the natural economy of the country. They protect the valleys from destructive avalanches, and, retaining the superficial soil by their roots, they mitigate the destructive effects of heavy rains. In valleys where they have been rashly cut away, and the waters pour down the slopes unchecked, every tiny rivulet becomes a raging torrent, that cuts away and carries off the grassy slopes and devastates the floor of the valley, covering the soil with gravel and debris. In the pine forests of the Alps the prevailing species are the common spruce and the silver fir; on siliceous soil the larch flourishes, and surpasses every other European species in height. The Scotch fir is chiefly found at a lower level, and rarely forms forests. The Siberian fir is found scattered at intervals throughout the Alps, but is not common. The mughus, creeping pine, or *Krummholz* of the Germans, is common in the Eastern Alps, and sometimes forms on the higher mountains a distinct zone above the level of its congeners. In the Northern Alps the pine forests rarely surpass the limit of 6000 feet above the sea, but on the south side they commonly attain to 7000 feet; and the larch, Siberian fir, and mughus often extend above that elevation.

5. *Alpine Region.*—Throughout the German Alps the word *alp* is used specifically for the upper pastures, where cattle are fed in summer, but this region is held to include the whole space between the uppermost limit of trees and the first appearance of permanent masses of snow. It is here that the characteristic vegetation of the Alps is developed in its full beauty and variety. Shrubs are not wanting. Three species of rhododendron vie with each other in the brilliancy of their masses of red or pink flowers; the common juniper rises higher still, along with three species of bilberry; and several dwarf willows attain nearly to the utmost limit of vegetation. The upper limit of this region coincides with the so-called limit of perpetual snow, which demands further explanation.

6. *Glacial Region.*—On the higher parts of lofty

mountains more snow falls in each year than is melted on the spot. A portion of this is carried away by the wind before it is consolidated, a larger portion accumulates in hollows and depressions of the surface, and is gradually converted into glacier-ice, which descends by a slow secular motion into the deeper valleys, where it goes to swell perennial streams. As on a mountain the snow does not lie in beds of uniform thickness, and some parts are more exposed to the sun and warm winds than others, we commonly find beds of snow alternating with exposed slopes covered with brilliant vegetation; and to the observer near at hand there is no appearance in the least corresponding to the term *limit of perpetual snow*. But the case is otherwise when a high mountain chain is viewed from a distance. Similar conditions are repeated at many different points, so that the level at which large snow-beds show themselves along its flanks is approximately horizontal. But this holds good only so far as the conditions are similar. On the opposite side of the same chain the exposure to the sun or to the warm winds may cause a wide difference in the level of permanent snow; but in some cases the increased fall of snow on the side exposed to moist winds may more than compensate the increased influence of the sun's rays. Still, even with these reservations, the so-called line of perpetual snow is not fixed. The occurrence of favorable meteorological conditions during several successive seasons may and does increase the extent of the snow-fields, and lower the limit of seemingly permanent snow; while an opposite state of things may cause the limit to rise higher on the flanks of the mountains. From these remarks it may be inferred that all attempts to fix accurately the level of perpetual snow in the Alps are fallacious, and can at the best approach only to local accuracy for a particular district. In some parts of the Alps the limit may be set at about 8000 feet above the sea, while in others it cannot be placed much below 9500 feet. As very little snow can rest on rocks that lie in an angle exceeding 60°, and this is soon removed by the wind, some steep masses of rock remain bare even near the summits of the highest peaks, but as almost every spot offering the least hold for vegetation is covered with snow, few flowering plants are seen above 10,000 feet.

At the earliest period at which records are preserved the Alps appear to have been mainly inhabited by Celtic tribes, some of which, before they were subjugated by the Romans, had made considerable progress in the knowledge of the useful arts. The Rhetians and Vandelicians especially, in whom a primitive Turanian stock seems to have been amalgamated with a dominant Celtic race, readily assimilated the civilisation of Rome; and the language of the conqueror, modified by peculiarities of pronunciation and the retention of some native terms, still survives in Eastern Switzerland, and in a few isolated valleys of Tyrol. Throughout by far the larger part of the Alps, however, the flood of Teutonic invasion either exterminated or drove into exile the previous population. Alemanni and other kindred tribes settled in the main valleys of the Eastern Alps, and finally became masters of the greater part of Switzerland, leaving to the original Celtic population the Western Alps and both slopes of the great Pennine chain. At a later period the invasion of Slavonic hordes threatened to substitute a new nationality throughout the same region, but after prolonged contests these tribes were restricted to its southeastern portion, being nearly confined to the upper valleys of the Drave and the Save, with their tributaries. The Italian valleys of the Alps, from the Val d'Ossola to the Tagliamento, inhabited by people of mixed race, have, with a few exceptions, preserved the language of Italy, much varied in the local dialects;

while the western districts, in which the Celtic element remained predominant, have for the most part clung to the French tongue. The estimates formed of the present population of the Alps are uncertain, because they usually include towns and populous districts lying without the mountain region. It is usually reckoned that there are about 1,500,000 of Celto-Gallic stock in the French and Savoy Alps, western Switzerland, and some valleys of Piedmont; about 4,000,000 of Teutonic origin in the Swiss and German Alps; about 1,000,000 of Slavonic stock, chiefly Slovenes; and about 1,000,000 of Italians in the valleys of Northern Italy, the Swiss cantons of Tessin and Grisons, and in the Italian Tyrol, making an aggregate of 7,500,000. To these should be added about 70,000 people speaking some dialect of the Rhaeto-Roman or Romansch. All these numbers excepting the last are excessive, if we would restrict the estimate within the proper limit of the Alps.

Although no conspicuous species of quadruped or bird is known to be exclusively confined to the Alps, they have afforded an asylum to many animals that have become rare or extinct elsewhere. The great urus, the elk, and the wild swine have disappeared since the Roman period, and the beaver in more recent times; but the brown bear, the lynx, the wild cat, and the wolf still survive. Among Ruminants, the red deer, fallow deer, and roebuck, chiefly found in the lower forest region, are common to other mountain districts. More characteristic of the Alps is the chamois, which is found elsewhere only in the Carpathians, Pyrenees, and the mountains of European Turkey, and is the sole representative of the antelopes in this part of the world. Much rarer is the ibex or bouquetin, which still lives in the higher Alpine region of the Graian Alps, and possibly also in some recesses of the Pennine chain. Unlike the chamois, which descends at night to find sustenance as low as the verge of the pine forests, this fine animal remains, at least in the summer, in the upper region, on the verge of the snow-fields, or on the rocks that rise amidst the glaciers. The massive horns of the male are often a yard or more in length. Closely allied species are found in the Pyrenees and other mountain ranges of the Iberian peninsula, and in the Caucasus, but the true ibex seems to be now confined to this small corner of the Alps.

The Birds of the Alps are proportionately very numerous. Many southern species find a home in the warmer Italian valleys, and there meet northern forms that descend during the winter and spring, but return to the upper zone in the warm season. Of the more conspicuous species of the high Alps, the lammereyger (*Gypaëtus barbatus*)—once common, but now becoming very rare—is pre-eminent. It is also found in Algeria, in Syria, and in Northern Asia, but is one of those animals that is threatened with extinction by the progress of civilisation.

The great lakes of the Alps are very rich in Fish, not only as regards the number of individuals, but in species also. Thus in Chiemsee, at the northern foot of the Bavarian Alps, thirty-three species have been found; in the lake of Constance twenty-six species, and twenty-four in the lake of Lucerne. The most esteemed are those of the trout and salmon tribe, whose specific differences have not yet been fully investigated by the ichthyologists. First in rank is the saibling (*Salmo salvelinus*), which flourishes in lakes between 2000 and 4000 feet above the sea, and occasionally extends to those of the Alpine region between 6000 and 7000 feet.

In describing the several regions which are found in ascending from the low country to the snow-clad summits of the Alps; and whose existence is due to climatal differences, it was necessary to refer to the characteristic vegetation of each zone, inasmuch as this affords the

chief apparent distinction which climatal conditions impress on the earth's surface. The most cursory observation suffices to show that within each of the zones thus broadly sketched out there exist marked differences in the vegetable population, so that a comparison of the local floras in two spots possessing a similar climate as regards temperature may exhibit but few points of agreement along with many marked contrasts. This partly depends on external conditions; of which the most important are differences in the amount and distribution of moisture in the air and the soil, and differences in the composition and state of aggregation of the soil itself. But a more important element in determining the flora of any particular district depends upon the causes which have operated throughout the whole period since it has become dry land to facilitate migration for certain species, and to impede it for others. The subject of distribution of Alpine plants, so far as regards the eastern half of the chain, has been very well discussed in an essay by Dr. A. Kerner in the 1st vol. of the 2d edit. of Schaubach's *Deutsche Alpen*, although some of the conclusions of the writer may not bear careful criticism. He divides the natural floras of the Alps into four—named respectively *Artic*, *Baltic*, *Pontic* and *Mediterranean*, the term *Baltic* referring to the region that includes Germany, Southern Scandinavia, and North-Western Russia; while *Pontic* comprehends the region north and west of the Euxine—the northern provinces of Turkey and the whole space between the Carpathians and the Crimea.

The phenomena of glaciers have been chiefly studied in the Alps, but they are not especially characteristic of the mountains of Central Europe. The investigation of their origin and structure, and the laws of their motion, fall within the province of the physical philosopher, and are discussed elsewhere. See GLACIERS.

The geological structure of the Alps is a subject that has occupied the labors of many eminent men of science, especially during the last thirty years, yet it may be safely asserted that it will continue to offer new problems to the researches of at least another generation. There is scarcely a single difficult question regarding the nature and mode of deposition of the strata that make up the earth's crust, the mode of elevation of mountain chains, the causes of the formation of valleys and lake basins, the action of meteoric forces, of rivers and ice-streams, that must not be decided before we can give a rational account of the structure of the Alps. Along with these, and scarcely less important, is the study of the various agencies involved in the phenomena of metamorphism, and that of the part played by volcanic action in some parts of the chain. The study of the organic remains embedded in the rocks is not so constantly the duty of the geologist in the Alps as it is in most other mountain districts; but of late years this has been actively pursued, and has tended to clear up many difficulties, while much room is left for further investigation.

ALPUJARRAS, or ALPUXARAS, a mountainous district in the south of Spain, in the province of Andalusia, lying between the Sierra Nevada and the Sierras Lugar and Contraviesa, and consisting principally of valleys, which descend at right angles from the crest of the Sierra Nevada. These valleys are among the most beautiful and fertile in Spain. Population, about 5,000.

ALREDUS, ALURED, or ALUREDUS, of Beverley, one of the earliest English historians, was born at Beverley, in Yorkshire. He wrote in the reign of Henry I., but little is known with certainty of his life. It is generally believed that he was educated at Cambridge, and afterward became one of the canons and treasurer of the church of St. John's at Beverley. A manuscript en-

titled *Liberates Ecclesie S. Johannis de Beverla*, in the Cottonian library, is also ascribed to him, but on doubtful authority. It is a collection of records relative to the church of Beverley. Alredus died in 1128.

ALRESFORD (NEW), a market town in Hampshire, so named from a ford on the river Arle, a tributary of the Itchin, on which it is situated. It is 58 miles distant from London, and 7 from Winchester.

ALSACE (Germ. *Elsass*), a former province of France, divided after the Revolution into the departments of Haut Rhin and Bas Rhin, and incorporated since the war of 1870 with the German empire. It is bounded on the north by the Rhine palatinate, on the east by the Rhine, on the south by Switzerland, and on the west by the Vosges Mountains; and it comprises an area of 3344 English square miles. The district possesses many natural attractions, and is one of the most fertile in central Europe. There are several ranges of hills, but no point within the province attains a great elevation. The only river of importance is the Ill, which falls into the Rhine after a course of more than 100 miles, and is navigable below Colmar. The hills are generally richly wooded, chiefly with fir, beech, and oak. The agricultural products are corn, flax, tobacco, grapes, and various other fruits. The country has a great wealth of minerals, silver having been found, and copper, lead, iron, coal, and rock-salt being wrought with profit. There are considerable manufactures, chiefly of cotton and linen. The chief towns are Mülhausen and Colmar in the upper district, and Strasburg in the lower. The province is traversed from east to west by the railway from Strasburg to Nancy, and the main line north and south runs between Basle and Strasburg.

Alsace suffered a good deal in the war of 1870-71. The earlier battles of the campaign were fought there; Strasburg and other of its fortified towns were besieged and taken; and its people were compelled to submit to very severe exactions. The civil and military government of the province, as well as that of Lorraine, was assumed by the Germans as soon as they obtained possession of those parts of France, which was very shortly after the commencement of the war. The people, notwithstanding their German origin, showed a very strong feeling against the invaders, and in no part of France was the enemy resisted with greater stubbornness. It was evident from an early period of the war, however, that Prussia was resolved to reannex Alsace to German territory. When the preliminaries of peace came to be discussed at Versailles in February 1871, the cession of Alsace, together with what is called German Lorraine, was one of the earliest conditions laid down by Count Bismarck and accepted by M. Thiers. This sacrifice of territory was afterwards ratified by the National Assembly at Bordeaux, though not without a protest from the representatives of the departments about to be given up; and thus Alsace once more became German. The German system of compulsory education of every child above the age of six was introduced directly after the annexation. The population in 1900 was 1,719,400. The area is 5,604 square miles.

ALSEN, an island in the Baltic, situated off the coast of Schleswig, in the Little Belt. It formerly belonged to Denmark, but, as a result of the Danish war of 1864, was incorporated with Germany. Population, 22,500.

ALSOP, VINCENT, a celebrated Nonconformist divine, was educated in St. John's College, Cambridge. He received deacon's orders from a bishop, whereupon he settled as assistant-master in the free school of Oakham, Rutland. He was recovered from indifferent associates here by a very worthy minister, the Rev. Benjamin King. A book against Sherlock, called *Antisoazo* (after Socinus), written in the vein of Andrew Marvell's

Rehearsal Transposed, procured him much celebrity as a wit. Besides fame, *Antisozzo* procured for its author an invitation to succeed the venerable Mr. Cawton in Westminster. The other books he published showed a fecundity of wit, a playful strength of reasoning, and a provoking indomitableness of rillery. Even with Dr. Goodman and Dr. Stillingfleet for antagonists, he more than held his own. His *Mischief of Impositions* in answer to the latter's *Mischief of Separation*, and *Melius Inquirendum* in answer to the former's *Compassionate Inquiry*, remain historical landmarks in the history of Nonconformity. He died May 8, 1703.

ALSTED, JOHANN HEINRICH, a German Protestant divine, and one of the most voluminous writers of the seventeenth century, was born in 1588. He was some time professor of philosophy and divinity at Herborn, in the county of Nassau, and afterward at Weissenburg in Transylvania, where he continued till his death in 1638. His *Encyclopædia*, the most considerable of the earlier of that class, was long held in very high estimation. His *Thesaurus Chronologicæ* has gone through several editions. He published in 1627 a treatise, *De Mille Annis*, in which he asserted that the reign of the saints on earth was to begin in 1694.

ALSTON, CHARLES, M.D., a botanical and medical writer, was born in the west of Scotland in the year 1683. He was a man of great ability, and an assiduous student of science. His most valuable work is his *Lectures on Materia Medica*. He died in 1760.

ALSTROEMER, JONAS, a Swedish industrial reformer, was born at Alingsaas, in West Gothland, on the 7th of January, 1685. He died June 2, 1761, leaving several works on practical industrial subjects. A statue was erected to his honor in the exchange at Stockholm. One of his sons, Clas (*i.e.*, Claude), was a naturalist of considerable eminence.

ALT, or ALUTA, a tributary of the Danube, which, rising in the eastern Carpathian mountains, flows through Transylvania and Wallachia, entering the latter by the pass of Rothenthurm, and joins the Danube opposite Nicopol, after a course of more than 300 miles.

ALTAI MOUNTAINS, a group of mountains in central Asia, separating the table-lands of Mongolia from Siberia. The range is rich in mineral productions, particularly silver, copper, and iron. See ASIA, and GEOGRAPHY, PHYSICAL.

ALTAMURA, a cathedral town in the south of Italy, province of Terra di Bari, twenty-eight miles southwest of Bari, at the base of the Apennines. Population, 19,817.

ALTAR, in *Classical Antiquity*, was a solid base or pedestal on which supplication was made and sacrifice offered to the gods and deified heroes. According to this difference in the service for which they were employed, altars fell into two classes, of which the one, smaller and lower so that the suppliant could kneel upon it, stood inside temples, in front of the sacred image; while the other, destined for burnt sacrifice, was placed in the open air, and, if connected with a temple, in front of the entrance. Possibly altars of the former class were substitutes for, and rendered the same service in historical times as, in an early age, the base of the sacred image within a temple. In this case the altar of Apollo and Delphi, on which Neoptolemus is frequently represented on the Greek vases as taking refuge from Orestes, might be regarded as the pedestal of an invisible image of the god, and as fulfilling the same function as did the base of the actual image of Minerva in Troy, towards which Casandra fled from Ajax. The other class of altars, called βωμοί by the Greeks and *altaria* by the Romans, appear to have originated in such temporary constructions as heaps of earth, turf, or

stone, made as occasion offered for kindling a fire for sacrifice. The next step was to allow the bones and ashes of the victims sacrificed to accumulate, and upon this to kindle new fires. Altars so raised were viewed with particular sanctity, the most remarkable recorded instances of them being the altars of Juno at Samus and at Olympia, of Apollo at Thebes, and of Jupiter at Olympia. The last-mentioned stood on a platform measuring 125 feet in circumference, and led up to by steps, the altar itself being 22 feet high. Women were excluded from the platform. The altar of Apollo at Delos was made of the horns of deer believed to have been slain by Diana; while at Miletus was an altar composed of the blood of victims sacrificed. The altar used at the festival in honor of Dædalus on Mount Cithæron was of wood, and was consumed along with the sacrifice. Others, of bronze, are mentioned; but while these were exceptional, the usual material of an altar was marble, and its form, both among the Greeks and Romans, either square or round; polygonal altars, of which examples still exist, being exceptions. When sculptured decorations were added they frequently took the form of imitations of the actual festoons with which it was usual to ornament altars, or of symbols, such as crania and horns of oxen, referring to the victims sacrificed. As a rule, the altars which existed apart from temples bore the name of the person by whom they were dedicated, and the names of the deities in whose service they were.

Egyptian altars were monoliths, in the form of a truncated cone about four feet in height. Some are extant, made of granite, others of green basalt; in almost every case they bear hieroglyphical inscriptions. In the temple of Jupiter at Babylon there was an altar of massive gold. Assyrian, Egyptian, and Persian altars were either square or oblong.

The most ancient altars of which any record has been preserved are those mentioned in the Bible. As sacrifice implies an altar, there must have been altars for those of Cain and Abel; but the first which is mentioned is that which Noah after the flood "built unto Jehovah." The three patriarchs, Abraham, Isaac, and Jacob, are repeatedly said to have built an altar in the different parts of the land of Canaan in which they sojourned; and though it is not stated expressly, yet it may be inferred from there having evidently been a place where Abraham was accustomed to "stand before Jehovah," that, once built, it remained during the whole period of the encampment at the particular place, and was frequently used for the purpose of sacrificing.

But the most remarkable altar mentioned in the book of Genesis is that which Abraham built for the sacrifice of his son Isaac, from which we glean several particulars relative to the patriarchal worship. The altar was evidently something distinct from the wood by whose fire the sacrifice was to be burnt, for Abraham "built an altar and laid the wood in order," which he had brought with him from Beersheba, as if he could not count upon finding it at the place. The victim also was bound, laid upon the wood, and there slain. This was contrary to the practice under the Levitical dispensation, when the fire on the top of the altar was kept continually burning, and the animal was killed before being carried up to it; but it is probably alluded to in a verse of the Psalms, which has given much trouble to commentators, who have tried to reconcile it with the precepts of the Mosaic law—"Bind the sacrifice with cords unto the horns of the altar."

The first altar that is mentioned as having been built after the directions were given, was the one for the solemn covenanting sacrifice between God and the Israelites. There it is mentioned that Moses "built an altar

under the hill, and twelve pillars, according to the twelve tribes of Israel." Its being *under* the hill may have been a significant protest against the prevalent heathen error of localising the Deity in the sky, and the twelve pillars or rough blocks of stone appear to have been a principal part of the materials used in constructing it.

The first of these altars was that for *burnt offerings*. For the tabernacle this was hollow, made of boards of shittim-wood, covered with brass. It was three cubits or about five feet high, and five cubits or eight feet square. It had a horn at each corner, and was carried about by means of staves. The corresponding altar in the temple was of greatly larger dimensions, ten cubits or about 18 feet high, and in the first temple 20 cubits square, and in the second 24 cubits. The tradition of the Jews is, that it was 32 cubits (about 50 feet) square at the base, contracting to 24 at the top, by several ledges round it at different heights. It must therefore have been an immense structure, and though called "an altar of brass, was probably built of stones, and merely covered with plates of that metal.

One of the most difficult questions about the Levitical altars is their having horns; for these do not seem to have been used in that ritual, yet they are specially ordered to be made, not only in the altar of burnt-offerings, but also in that of incense; and on certain solemn occasions they were sprinkled with blood, as if they were not mere appendages or ornaments of the altar, but had a special significance of their own. From the way they are spoken of in the book of Exodus, we see that they must then have been well known, and it might almost be thought that they were retained from the older ritual, according to which they were used to bind the victim that was slain upon the altar.

The second altar belonging to the Jewish worship was the *altar of incense*, the golden altar. It was placed in the holy place, between the table of shew-bread and the golden candlestick. This altar, in the tabernacle, was made of shittim-wood overlaid with gold plates, 1 cubit in length and breadth, and 2 cubits in height. It had horns of the same materials; and round the flat surface was a border of wrought gold, underneath which were the rings to receive "the staves, made of shittim-wood overlaid with gold, to bear it withal."

The single exception to the exclusive use of the golden altar for incense was on the great day of atonement, when the high priest went into the holy of holies, carrying a fire-pan containing lighted charcoal from the great altar, and having set it down, threw incense upon it, and left it for some time before the ark while he went and came back once and again to sprinkle it with the blood of the sacrifices. This fire-pan is accordingly called a golden censer by the author of the Epistle to the Hebrews (ix. 4); but even this is no precedent for the swinging censers which have been used for so many centuries in the Latin churches. Incense, indeed, was put on the loaves of shew-bread; but it does not appear that it was burned upon that table, which is nowhere called an altar.

Among the early Christians, alike in the East and West, that on which the bread and wine were put in the celebration of the Eucharist appears to have been regarded as an altar, and accordingly sacrificial words were used in connection with it, such as "offering," "unbloody sacrifice."

From the privacy with which the early believers had to meet, their altars at first would naturally be simple and unobtrusive. We have seen that the Levitical altars were four-square, but Christian altars seem to have been always longer than they were broad, and to have been placed "athwart" the length of the basilica,

or church, so as to present one of the broad sides and both the sacred vessels to the eyes of the great body of worshippers.

There does not seem to have been any rule as to the material of which altars might be made. At first they appear to have been mostly of wood, as being easily procured and fashioned. But when the persecutions ceased, and the Christians began to erect churches for worship, there seems to have sprung up some diversity of usage, each province following its own traditional custom, which perhaps was affected in some degree by the nature of the building-stone found there, and the use commonly made of it. It seems that in Egypt and the region afterwards called Barbary the altars were of wood; and there is a tradition that this was also the case originally at Rome. On the other hand, in the latter half of the 4th century, they were made of stone in Asia Minor. Early in the 6th century a council, held at Epaone in Burgundy, ordered that only altars made of stone should be consecrated with the chrism, which shows that wooden altars also were still made in that province. In England the change from wood to stone seems to have taken place about the time of the Norman Conquest, Wulfstan, bishop of Worcester, being mentioned as having introduced it in his diocese.

At the Reformation the altars in the churches were looked upon as symbols of the old Catholic doctrine, in those countries where the struggle lay between the Catholic and the "Reformed" or Calvinists, who on this point went much further than the Lutherans. In England the name "altar" was retained in the Communion Office in English, printed in 1548, and in the complete English Prayer-book of the following year, known to students as the first book of Edward. But orders were given soon after that the altars should be destroyed, and replaced by movable wooden tables; while from the revised Prayer-book of 1552 the word "altar" was carefully expunged.

The name "altar" has been all along retained in the Coronation Office of the kings of England, where it occurs frequently. It was also recognized in the canons of 1640, and an important change was then made in the position of the communion tables, which has become universal throughout the Church of England. In primitive times the position of the Christian altar seems to have been such that, like the Jewish and patriarchal altars, they could be surrounded on all sides by the worshippers. The chair of the bishop or celebrant was on the west side, and the assistant clergy were ranged on each side of him. But in the Middle Ages the altars were placed against the east wall of the churches, or else a screen, called a *reredos* (generally much decorated with carving), was erected close to the east of the altar, so as to cut off any one on that side from joining in the worship, and the celebrant was brought round to the west side, to stand between the people and the altar; while there were often curtains on the north and south sides.

In early times, before the altars were placed close to the east wall or to a large *reredos*, they were often surmounted by a canopy or baldacchino, supported by four pillars rising from the ground just beyond the corners of the altar.

At first there was but one altar in a church; but for many centuries this rule has been disregarded in the Latin churches, and almost every large church contains several altars dedicated in honor of different saints, and sometimes appropriated to the use of particular guilds, or endowed for a series of masses for the repose of the founder. These, however, must not be confounded with the principal altar, called the high altar or *maître autel*, situated towards the east end of the choir or

chancel. A few cases occur where there are two high altars, the second being placed near the west end of the church.

ALTAZIMUTH, an astronomical instrument for determining the apparent places of the heavenly bodies on the celestial sphere. It consists of a telescope revolving about a horizontal axis, which in turn revolves about a vertical axis, the angle of revolution being measured in each case by a divided circle. The angles give the altitude and azimuth of the body at the instant of observation. Small instruments of this kind are used in surveys, but they are liable to errors.

ALTDORF, or **ALTORF**, a town in Switzerland, capital of the canton of Uri, situated at the northern end of the pass of St. Gotthard, near the lake of Lucerne. Bürglen, a village of the neighborhood, is Tell's reputed birthplace. Population, 2,724.

ALTDORFER, **ALBRECHT**, a painter and engraver of the early German school, was born at Regensburg, not later than 1480, and died in 1538. His engravings on wood and copper are very numerous, and rank next to those of Albert Dürer.

ALTENBURG, a town in Germany, capital of the dukedom of Saxe-Altenburg, situated near the river Pleisse, about twenty-four miles south of Leipsic. There is considerable traffic in grain and cattle brought from the surrounding district; twice a year there are large horse fairs; and the book trade is extensive. Cigars, woolen goods, gloves, hats, and porcelain are among the chief manufactures. Population (1900), 37,110.

ALTEN OETTING, or **ALTOETTING**, a small market town in Upper Bavaria, situated on the Mörn, not far from its junction with the Inn. Population, 1,600.

ALTENSTEIN, a castle upon a rocky mountain in Saxe-Meiningen, on the southwestern slope of the Thüringer Wald, not far from Eisenach. It is the summer residence of the dukes of Meiningen, and is surrounded by a noble park, which contains, among other objects of interest, a remarkable underground cavern, 500 feet long, through which flows a large and rapid stream.

ALTERATIVES, in medicine, a term applied to remedies that improve the nutrition of the body without exerting any very perceptible action on individual organs. Among the most important are preparations of arsenic, mercury, iodine and phosphorus, cod-liver oil, colchicum, guaiacum and sarsaparilla. Many of them are violent poisons when taken in improper doses.

ALTIN, a lake of Siberia, which gives rise to the Bija, one of the head streams of the Obi, is situated among the Altai mountains, 320 miles south of Tomsk.

ALTING, **HEINRICH**, a German divine, was born at Embden in 1583. His father, Menso Alting, was minister of Embden, and early destined his son to the same profession. He studied with great assiduity and success at the universities of Herborn and Gröningen. In 1608 he was appointed tutor of Frederick, afterward elector-palatine, at Heidelberg, and in 1612 accompanied him to England. Returning in 1613 to Heidelberg after the marriage of the elector with the Princess Elizabeth of England he was appointed professor of theology, and in 1616 director of the *Collegium Sapientia*. In 1627 Alting obtained leave from his patron to remove to Gröningen, where he was appointed to the chair of divinity, and there he continued to lecture, with increasing reputation, until his death, which took place in 1644.

ALTING, **JACOB**, son of the preceding, was born at Heidelberg in 1618. He studied theology and the Oriental languages at Gröningen, and in 1638 he put himself under the tuition of a Jewish rabbi at Embden. His opinions, which seem to have excited more general attention than they deserve, may be seen in his writings, which were collected a few years after his death, and

published in five volumes folio, by his pupil, the well known Balthasar Bekker.

ALTITUDE, in astronomy, is the height of a heavenly body above the horizon. In observatories altitudes are taken by a telescope attached to a graduated circle, the readings being corrected for parallax and refraction. At sea the altitude is taken by a sextant, and corrected by allowing for the dip of the visible horizon below the true horizon.

ALTO, in Music, is properly the same as counter tenor, the male voice of the highest pitch.

ALTON, a town of Hampshire, on the Wey, seventeen miles east of Winchester, and forty-seven southwest of London by road; by the London and South-Western railway it is sixty miles from London. Pop. about 6,000.

ALTON, the leading city of Madison county, Ill., is situated on the Mississippi river twenty-five miles from St. Louis, and 282 miles southwest of Chicago. The Chicago and Alton; Chicago, Burlington and Quincy; Indianapolis and St. Louis; and St. Louis, Alton and Springfield railroads pass through the city. It also has communication with Mississippi river points by steamers. It contains two banks, three daily and three weekly newspapers, thirteen churches, a high school, academy, and primary schools, a Catholic hospital and convent, four hotels, public halls, stores, and extensive manufacturing industries, including organs, plows, miners' tools, agricultural implements, hardware specialties, etc. A large military prison was located here during the Civil war. Population (1900), 14,210.

ALTONA, the richest and most populous city of the Prussian province of Schleswig-Holstein, is situated on the north bank of the Elbe, so close to Hamburg that the two cities are virtually one. The rise of Altona to its present position has been rapid, at least for a continental city, and is mainly due to the fostering care of the Danish government, who established it as a rival to Hamburg. In 1640, when it became the property of Denmark, it was a small fishing village; in 1900 it contained 161,507 inhabitants. After the war of 1864 it ceased to belong to Denmark, and eventually became part of Prussia, although, with Hamburg, it is not included in the Zollverein.

ALTOONA, a town of the United States, in Blair county, Pennsylvania, on the Central Railway, 244 miles west of Philadelphia, situated near the eastern base of the Alleghany Mountains where the railroad begins to ascend them. Its situation at this point was the inspiration of that famous engineering feat, the erection of "Horseshoe Bend." The town is essentially a manufacturing community, some of the most extensive machine works in the world being located here. One of the largest of these is the locomotive and repair works of the Pennsylvania railroad, in which over 5,000 men are employed. The town has ample banking and telegraph accommodations, churches and schools. Several newspapers are published here. Its growth has been rapid, the increment of population and wealth being about 100 per cent. in the past ten years. Pop. (1900), 38,973.

ALTO-RILIEVO (*high relief*), is the term applied to sculpture that projects from the plane to which it is attached to the extent of more than one-half the outline of the principal figures. Some of the finest works of art are in such relief.

ALTRINGHAM, or **ALTRINCHAM**, a market town in the north of Cheshire, eight miles south of Manchester. Population, 11,249.

ALUM, a compound salt employed in dyeing and various other industrial processes. It is soluble in water, has an astringent acid, and sweetish taste; reddens vegetable blues, and crystallizes in regular

octahedrons. When heated, it liquefies; and if the heat be continued, the water of crystallisation is driven off, the salt frothes and swells, and at last a white matter remains, known by the name of *burnt alum*.

Its constituents are sulphuric acid, alumina, an alkali, and water. The alkali may be either *potash*, *soda* or *ammonia*. Hence there are three distinct species of alum, depending upon the nature of the alkali which each contains.

The progress made by chemists in the discovery of the constitution of alum was very slow. The species first investigated was potash alum. That it contained sulphuric acid as a constituent was known even to the alchemists. Pott and Marggraff demonstrated that alumina was another constituent. Pott, in his *Litho-geognosia*, showed that the earth of alum, or the precipitate obtained when an alkali is poured into a solution of alum, is quite different from lime and chalk, with which it had been confounded by Stahl. Marggraff went much farther. He not only showed that alumina is one of the constituents of alum, but that this earth possesses peculiar properties, is different from every other substance, and is one of the ingredients in common clay. Marggraff showed likewise, by many experiments, that crystals of alum cannot be obtained by dissolving alumina in sulphuric acid, and evaporating the solutions. The crystals formed are always soft, and quite different in their appearance from alum crystals. But when a solution of potash or ammonia is dropped into this liquid, it immediately deposits perfect crystals of alum ("Sur la Régénération de l'Alun," Marggraff's *Opusc.* ii. 86). He mentions likewise that manufacturers of alum in general were unable to procure the salt without a similar addition; that at first it had been customary to add a quantity of putrid urine, and that afterward a solution of carbonate of potash was substituted in its place. But subsequent chemists do not seem to have paid much attention to these important observations of Marggraff; they still continued, without any rigid examination, to consider alum as a sulphate of alumina.

The word *alumen*, which we translate *alum*, occurs in Pliny's *Natural History*. In the 15th chapter of his 35th book he gives us a detailed description of it. By comparing this with the account of *στυπτηρία* given by Dioscorides in the 123rd chapter of his 5th book, it is obvious that the two are identical. Pliny informs us that alumen was found naturally in the earth. He calls it *salsugo terra*. Different substances, he informs us, were distinguished by the names of alumen; but they were all characterised by a certain degree of astringency, and were all employed in dyeing and medicine. The light-colored alumen was useful in brilliant dyes, the dark-colored only in dyeing black or very dark colors. One species was a liquid, which was apt to be adulterated; but when pure it had the property of striking a black with the juice of the pomegranate. This property seems to characterise a solution of sulphate of iron in water. It is quite obvious that a solution of our alum would possess no such property. Pliny says that there is another kind of alum which the Greeks call *schistos*. It forms in white threads upon the surface of certain stones. From the name *schistos*, and the mode of formation, there can be little doubt that this species was the salt which forms spontaneously on certain slaty minerals, as alum slate and bituminous shale, and which consists chiefly of sulphate of iron and sulphate of alumina. Possibly in certain places the sulphate of iron may have been nearly wanting, and then the salt would be white, and would answer, as Pliny said it did, for dyeing bright colors. Several other species of alumen are

described by Pliny, but we are unable to make out to what mineral he alludes.

The alumen of the ancients, then, was not the same with the alum of the moderns. It was most commonly a sulphate of iron, sometimes probably a sulphate of alumina, and usually a mixture of the two. But the ancients were unacquainted with our alum. They were acquainted with sulphate of iron in a crystallised state, and distinguished it by the names of *misy*, *sory*, *chalcanthum*. As alum and green vitriol were applied to a variety of purposes in common, and as both are distinguished by a sweetish and astringent taste, writers, even after the discovery of alum, do not seem to have discriminated the two salts accurately from each other. In the writings of the alchemists we find the words *misy*, *sory*, *chalcanthum*, applied to alum as well as to sulphate of iron; and the name *atramentum sutorium*, which ought to belong, one would suppose, exclusively to green vitriol, applied indifferently to both.

When our alum was discovered is entirely unknown. Beckmann devoted a good deal of attention to the history of this salt, and published a curious dissertation on the subject; but his attempts to trace its origin were unsuccessful. The manufacture of it was discovered in the East, but at what time or place is totally unknown. It would appear that, about four or five hundred years ago, there was a manufactory of it at Edessa in Syria, at that time called *Rocca*,—hence, it is supposed, the origin of the term *rock alum*, commonly employed in Europe; though others allege that the term originated at Civita Vecchia, where alum is made from a yellow mineral which occurs in the state of a hard rock.

Different alum works existed in the neighborhood of Constantinople. About the time of the fall of the Grecian empire the art of making alum was transported into Italy, at that period the richest and most manufacturing country in Europe.

England possessed no alum works till the reign of Charles I. Thomas Chaloner, son of Dr. Chaloner, who had been tutor to Charles, while hunting on a common in Yorkshire took notice of the soil and herbage, and tasted the water.

Several alum works exist in Sweden, particularly in West Gothland.

Various minerals are employed in the manufacture of alum, but by far the most important of them are the following three: *alum-stone*, *alum-slate*, *bituminous shale*.

Alum-stone or Alunite was first observed at Tolfa, near Rome, in the 15th century, and afterwards in Hungary and several other places, chiefly in trachyte or other volcanic rocks. It appears to be produced by the action of sulphureous vapors on the felspars they contain, and generally occurs in compact, granular, or earthy masses, mixed with quartz or feldspar.

Alum-slate is a far more abundant substance, occurring in bed in different formations. Thus it is common in the older Paleozoic or Silurian strata of Scandinavia and Scotland. Generally it is distinctly slaty, but sometimes forms rounded balls or concretions. It contains much carbonaceous matter, and hence its color is greyish or bluish-black. It has a dull lustre, is soft and sectile. It contains much disseminated iron pyrites, and on decomposition in the air yields sulphate of iron, and alum as an efflorescence on the surface.

Several native varieties of sulphate of alumina and soda alum occur in South America, some of the most remarkable of which it may be proper to specify.

1. Sulphate of alumina, or Alunogene, was first found at Rio Saldanha, but is now obtained from several places in Europe and America.

2. Soda-alum. It occurs native in the province of

St. Juan, situated to the north of Mendoza, on the east side of the Chilian Andes, at about 30° S. lat. The alum is white, and composed of fibres adhering longitudinally, and having a certain breadth, but very thin. When exposed to heat, it behaves very nearly as common alum.

3. There is a mineral called *aluminite*, which was observed in the environs of Halle many years ago, and which was afterwards detected by Mr. Webster in clay resting on chalk at Newhaven in Sussex. It consists of alumina, sulphuric acid, and water.

ALUMINIUM—sym. Al, eq. 27.4—is one of the metals present in clay, feldspar, slate, and many more rocks and minerals. It was discovered by Wöhler in 1828, and was re-examined by him in 1846, when he obtained the metal in minute globules or beads, by heating a mixture of chloride of aluminium and sodium. In 1855 the French chemist Deville showed, as the result of a series of experiments, that aluminium could be prepared on a large scale and in a compact form without much difficulty. The mineral cryolite found in Greenland, which is a double fluoride of aluminium and sodium, was the ore first used for its manufacture; but bauxite, a mineral found in France, and consisting chiefly of alumina or oxide of aluminium, and oxide of iron, has more recently been employed as a convenient source of the metal. An aluminate of soda is first obtained by heating the bauxite with soda ash in a furnace, and separating it (the aluminate) from the insoluble portions by lixiviation. When carbonic acid is passed through the solution, pure alumina is thrown down. The alumina is then formed into balls with common salt and charcoal, which are heated in an earthenware retort through which chlorine gas is passed. In this part of the process, the charcoal combines with the oxygen, and the chlorine with the aluminium; the latter sublimes over with the common salt (chloride of sodium), and is collected as a double chloride of aluminium and sodium. When this double chloride is heated in a reverberatory furnace with fluxes and metallic sodium, the latter seizes the chlorine combined with the aluminium, which is then set free, and falls to the bottom ready to be cast into ingots for use. The manufacture of aluminium was started in 1860 near Newcastle, by Mr. (afterward Sir) I. L. Bell; but owing to the restricted demand for the metal, the works were stopped, and it has been since chiefly manufactured in France. Recently, however, works have again been started in England by the Aluminium Crown Metal Company at Hollywood, near Birmingham. Here the metal is made from alum. Large works have also been started at various points in the United States.

The properties of aluminium are, that it is a white metal, somewhat resembling silver, but possessing a bluish hue, which reminds one of zinc. This bluish color can be whitened by hydro-fluoric and phosphoric acids, and also by a heated solution of potash. It is very malleable and ductile, in tenacity it approaches iron, and it takes a high polish. It fuses at about 1292° F. (700 C.) and can then be cast in molds into ingots. Exposed to dry or moist air, it is unalterable, and does not oxidize or tarnish like most common metals. Neither cold nor hot water has any action upon it. Sulphuretted hydrogen, the gas which so readily tarnishes the silver in households, does not act on aluminium, which is found to preserve its appearance under all ordinary circumstances as perfectly as gold does. When cast into molds, it is a soft metal like pure silver, and has a density of 2.56; but when hammered or rolled, it becomes as hard as iron, and its density increases to 2.67. It is therefore a very light metal, being lighter than glass, and only one-fourth as heavy

as silver. Aluminium is very sonorous, a bar of it when struck giving out a very sweet, clear, ringing sound. It is a good conductor of heat and electricity. Considerable difficulty was long experienced in working the metal, for want of a suitable solder. That generally used consists of aluminium, 6 per cent; copper, 4 per cent; and zinc, 90 per cent.

Aluminium in the Arts. This white metal never occurs pure in nature, but is abundant in all clays as a silicate. Formerly one of the most costly of metals, it is now becoming very cheap by reason of the invention, a few years since, of processes of extraction by electricity. The metal is valuable in the pure state for domestic utensils, and alloyed with copper in excellent bronzes. It can be cast, rolled, and forged, and when certain soldering difficulties are overcome, it will become a serious rival to copper in the form of wire for electrical purposes. Such articles as coins, medals, statuettes, and many other things, for which its strength and lightness render it particularly suitable, have been manufactured from aluminium. It is used for optical, surgical and chemical instruments. Aluminium leaf and wire may be employed with advantage in place of silver leaf for decoration, or silver wire for embroidery.

Aluminium Bronze.—Aluminium forms, with copper, several light, very hard, white alloys; also a yellow alloy, which, though much lighter than gold, is very similar to it in color. This gold-like alloy, which is ordinary aluminium bronze, contains from 5 to 10 per cent of aluminium, and is very strong, was discovered by Dr. Percy of London. For many years it has been manufactured into watch chains, pencil cases and other small ornamental articles. More lately it has been made on a limited scale into such articles as table-plate and carriage mountings which have an attractive appearance. This bronze, which can be made with a tensile strength equal to that of steel, has certain advantages for field-guns. Its anti-friction and wearing qualities make it well adapted for bearings of shafts; but its price being considerably in excess of ordinary bronze, somewhat hinders its use on a large scale for objects of utility. An alloy of aluminium and tin is used for optical instruments, and from another of aluminium and silver called "Tiers Argent," excellent spoons and forks are made.

ALUM ROOT. This name is given to two species of plants, common in the United States, and which, though differing greatly from each other, agree in the remarkable astringency of their roots, which are used in medicine. One of these plants is *Geranium maculatum*, which contains more tannin than Kino does. The other species is known as *Heuchera Americana*, and belongs to the order *Saxifragaceæ*. The root is a powerful styptic.

ALUTA, an affluent of the Danube. See ALT.

ALVA, a village in Shropshire, Scotland, situated as the foot of Craighleith, one of the Ochil range, 7 miles N.E. of Stirling, with which it is connected by railway.

ALVA, or **ALBA**, **FERNANDO ALVAREZ DE TOLEDO**, Duke of, born in 1508, was descended from one of the most illustrious families in Spain. His grandfather, Ferdinand of Toledo, educated him in military science and politics; and he was engaged with distinction at the battle of Pavia while still a youth. Selected for a military command by Charles V., he took part in the siege of Tunis (1535), and successfully defended Perpignan against the Dauphin of France. He was present at the battle of Mühlberg (1547), and the victory gained there over John of Saxony was due mainly to his exertions. In 1567, Philip, who was a bigoted Catholic, sent Alva into the Netherlands at the head of an army of 10,000 men, with unlimited powers for the extirpation of heretics. When he arrived he soon showed how much

he merited the confidence which his master reposed in him, and instantly erected a tribunal which soon became known to its victims as the "Court of Blood," to try all persons who had been engaged in the late commotions which the civil and religious tyranny of Philip had excited. He imprisoned the counts D'Egmont and Horn, the two popular leaders of the Protestants, brought them to an unjust trial, and condemned them to death. In a short time he totally annihilated every privilege of the people, and, with unrelenting cruelty, put multitudes of them to death. The executioner was employed in removing all those friends of freedom whom the sword had spared. The exiles from the Low Countries, roused to action by his oppression, fitted out a fleet of privateers, and after strengthening themselves by successful depredations, ventured upon the bold exploit of seizing the town of Breil. Thus Alva, by his cruelty, became the unwitting instrument of the future independence of the seven Dutch provinces. The fleet of the exiles having met the Spanish fleet, totally defeated it, and reduced North Holland and Mons. Many cities hastened to throw off the yoke; while the States-General, assembling at Dordrecht, openly declared against Alva's government, and marshalled under the banners of the Prince of Orange. Alva's preparations to oppose the gathering storm were made with his usual vigor, and he succeeded in recovering Mons, Mechlin, and Zutphen, under the conduct of his son Frederick. With the exception of Zealand and Holland, he regained all the provinces; and at last his son stormed Waerdan, and massacring its inhabitants, proceeded to invest the city of Haarlem, which, after standing an obstinate siege, was taken and pillaged. Their next attack was upon Alkmaar; but the spirit of desperate resistance was raised to such a height in the breasts of the Hollanders that the Spanish veterans were repulsed with great loss, and Frederick constrained reluctantly to retire.

On his return he was treated for some time with great distinction by Philip. In 1581 Alva entered Portugal, defeated Antonio, drove him from the kingdom, and soon reduced the whole under the subjection of Philip. Entering Lisbon, he seized an immense treasure, and suffered his soldiers, with their accustomed violence and rapacity, to sack the suburbs and vicinity. It is reported that Alva, being requested to give an account of the money expended on that occasion, sternly replied, "If the king asks me for an account, I will make him a statement of kingdoms preserved or conquered, of signal victories, of successful sieges, and of sixty years' service." Philip deemed it proper to make no further inquiries. Alva, however, did not enjoy the honors and rewards of his last expedition, for he died in January 1583, at the age of 74.

ALVARADO, PEDRO DE, one of the Spanish leaders in the discovery and conquest of America, was born at Badajoz about 1495. He held a command in the expedition sent from Cuba against Yucatan in the spring of 1518, and returned in a few months, bearing reports of the wealth and splendor of Montezuma's empire. During a visit to Spain, three years later, he had the governorship of Honduras conferred upon him in addition to that of Guatemala. He died in Guatemala in 1541.

ALVAREZ, FRANCISCO, born at Coimbra after 1460, a priest and almoner to Dom Manuel, king of Portugal, was sent in 1515 as secretary to Duarte Galvão, on an embassy to David, king of Abyssinia. The precise date of his death, like that of his birth, is unknown; but it must have been later than 1540, in which year he published at Lisbon, under the king's patronage, an account of his travels, in one volume folio, entitled *Verdadeira Informaçam do Preste Joas das Indias*.

ALVAREZ, DON JOSÉ, the foremost Spanish sculptor of modern times, was born in Priego, in the province of Cordova, in 1768, and died at Madrid in 1827. Bred to his father's trade of a stone-mason, he devoted all his spare time to drawing and modelling. In his twentieth year he became a pupil of the Academy of Granada. The most important of his numerous works, executed during this period, was a group representing Antiochus and Memnon, which was commissioned in marble (1818) by Ferdinand VII., and secured for the artist the appointment of court sculptor. It is now in the Museum of Madrid.

ALVAREZ, DON MANUEL, a Spanish sculptor, was born at Salamanca in 1727, and died in 1797. His works, which are very numerous, are chiefly to be found at Madrid.

ALWAR, a semi-independent state of Rájputaná, and under the control of the Governor-General's agent. Rájputaná, is bounded on the E. by the state of Bhartpur and the British district of Gurgáon, on the N. by Gurgáon district and the states of Pátialá and Nábhá, on the W. by the states of Nábhá and Jaipur, and on the S. by the states of Jaipur and Bhartpur. Its configuration is irregular, the greatest length from north to south being about 80 miles, and breadth from east to west about 60 miles, with a total area of about 3000 square miles. The total population of the state, as ascertained by a census taken in 1891 was 767,786, consisting of 598,333 Hindus, 180,225 Mahometans, and 38 Christians. Pop. of town (1901), 56,740.

ALYPIUS, one of the seven Greek writers on music whose works are collected and published, with a commentary and explanatory notes, by Meibomius (*Antiqua Musica Auctores Septem*, Amstel., 1652). The time in which he flourished cannot be precisely ascertained. He is said to have written before Euclid and Ptolemy; and Cassiodorus arranges his work, entitled *Introduction to Music*, between those of Nicomachus and Gaudentius.

ALYPIUS OF ANTIOCH, a geographer of the 4th century, who was sent by the Emperor Julian into Britain as prefect, and was afterwards commissioned to rebuild the temple at Jerusalem. Among the letters of Julian are two (29 and 30) addressed to Alypius; one inviting him to Rome, the other thanking him for a geographical treatise, which no longer exists.

ALYTH, a town on the eastern borders of Perthshire, in a parish of the same name, situated in the valley of Strathmore, 13 miles west of Forfar. Pop. 3,100.

AMADEUS V., surnamed the *Great*, Count of Savoy, was born at Bourget in 1249, and succeeded his uncle Philip in 1285. The cautious prudence of Amadeus enabled him greatly to increase his territory by means of marriage, purchase, and donations. He gradually rose to such eminence among the European powers, that he was constituted their umpire to settle their differences—an office which he performed with much reputation to himself and advantage to them. In 1310 he was created a prince of the empire by Henry VII. Amadeus undertook a journey to Avignon to persuade Pope John XXII. to preach a crusade in favor of Andronicos. He died there in the year 1323.

AMADEUS VIII., Count and first Duke of Savoy, and latterly pope or anti-pope, under the name of Felix V., was born at Chambéry in 1383, and succeeded his father, Amadeus VII., in 1391. Having by purchase or otherwise, added large territories to his patrimonial possessions, he became so powerful that the Emperor Sigismund erected Savoy into a duchy in 1416; and after his elevation Amadeus added Piedmont and other provinces to his dominions. After this increase of rank and of territory he suddenly, in 1434, retired to a monastery at Ripaille. Amadeus died at Geneva in 1451.

AMADIS OF GAUL. The best edition for English readers of this famous work is to be found in the abridged translation of Southey, and the best account of it is to be found in his preface, which, however, is not void of error. Here, for example, is its final sentence:—"*Amadis of Gaul* is among prose what *Orlando Furioso* is among metrical romances—not the oldest of its kind, but the best." When the licentiate and the barber burnt the library of Don Quixote, they spared from the flames only three romances—*Amadis of Gaul*, *Palmerin of England*, and *Tirante the White*. "I have heard," said the licentiate, "that *Amadis of Gaul* was the first book of chivalry printed in Spain, and that all the rest sprung from it; I think, therefore, as head of so pernicious a sect, we ought to condemn him to the fire without mercy." "Not so, sir," said the barber, "for I have heard also that it is the best of all the books of this kind; and therefore—as being unequalled in its way—it ought to be spared." "You are right," said the priest, "and for that reason its life is granted." Southey thinks that the work, as it left the hands of Lobeira, ended in the fourth book with the marriage of Amadis and Oriana, and that all which follows is due to the tasteless accretions of Montalús. Although this is mere conjecture, still it is natural that we should attach no little force to the correct feeling of Southey. For the story itself, it is impossible to give a summary of it—the plot being too disconnected; but he who has read one such tale, or even a few chapters of one, may have a general impression of all—hacking and hewing in every page, knights always at war and seeking adventures, giants in the path, lions in the forest, damsels in durance, castles to be attacked, wizards and witches with hate in their hearts, kings everywhere plentiful as blackberries, and lovely ladies abounding in tenderness. The sentiment of the work is very noble, and some of the descriptions are full of fire; but the reader owes more than he is aware to the curtailments of Southey.

AMADOU (*Polyporus fomentarius*), a fungus that grows upon old trees, especially the oak, ash, fir and cherry. When beaten soft it is used as a styptic for slight hæmorrhage, and as material for surgical pads.

AMAGER, or **AMAK**, a small island belonging to Denmark, lying in the Sound, close to the east coast of Seeland. Population about 9,000, exclusive of the inhabitants of Christianshafen. The other towns are Dragoe and Castrup.

AMALASONTA, or **AMALASUENTHA**, daughter of Theodoric, king of the Ostrogoths, was born about 498 A.D. In 515 she married Eutharic, the last representative of the Amalia family, who died (524–5), leaving an only son, Athalaric. The latter was designated by his grand-father Theodoric as the heir to the throne, and Amalasontha was appointed his guardian. On the death of Theodoric in 526, Amalasontha became regent, and endeavored by a wise and vigorous administration to carry on the work of civilization and enlightenment which her father had commenced. She devoted herself with special solicitude to the education of Athalaric, but her efforts were frustrated by the opposition of the Gothic nobles. Encouraged by them, the young heir to the throne threw off the restraints imposed by his mother, plunged into debauchery, and died at the age of sixteen (534). In the same year Amalasontha married her cousin Theodahadus, and made him co-regent with herself. A few months later (April 535) she was assassinated by order of her husband on an island on Lake Bolsena.

AMALEKITES, an ancient people, widely spread throughout the country lying on the south and east of Palestine, often mentioned in the Jewish Scriptures, and celebrated also in Arabian tradition. In Scripture they

occur first in Gen. xiv. 7, occupying the territory around Kadesh, and suffering from the invasion of Chedorlao-mer and his confederates. They appear next assaulting the Israelites, shortly after the exodus from Egypt, at Rephidim, in the neighborhood of Mount Sinai. In the time of the judges they are found associated with the Moabites, the Ammonites, the Midianites, and "the children of the east," in repeated attacks upon the Israelites, invading their territory from the eastern side of Jordan. Saul, by divine command, led an expedition into the country of Amalek, waging against them an exterminating war, "smiting them from Havilah until thou comest to Shur, that is over against Egypt."

Josephus agrees with Scripture in assigning to the Amalekites the territory immediately to the south of Palestine. Thus he speaks of them as inhabiting "Gobolitis and Petra." The country which they are thus represented as occupying is suited only to a nomadic population; and accordingly the indications of the Scripture narrative point to this as the general character of the Amalekite people.

AMALFI, a town of Italy, in the Principato Citeriore, situated at the entrance of a deep ravine on the north side of the Gulf of Salerno. It was founded, according to the common account, under Constantine the Great, and was one of the first cities to recover from the irruption of the barbarians into Italy. During the 10th and 11th centuries it was an independent republic of great commercial importance, with a trade which extended to Egypt and the east, and a population of 50,000. Flavia Gioja, to whom the invention of the mariner's compass has been ascribed, and Masoniello were born in Amalfi. Present population under 5,000.

AMALGAM, the name given to an alloy of mercury and another metal. The amalgams are a very numerous class of compounds, and many of them are used largely in the arts. Many amalgams are produced by direct contact of the metals, with evolution of heat. Others are obtained by the action of the mercury on the salt of the metal, or the action of the metal on a salt of mercury; assisted by the passage of a weak electric current in some cases. Some amalgams are solid, and others liquid.

AMALIA, **ANNA**, Duchess of Saxe-Weimar, was born at Wolfenbüttel on the 24th of October 1739, and married Duke Ernest of Saxe-Weimar in 1756. Her husband died in 1758, leaving her regent for their infant son, Karl August. She died on the 10th April 1807. A memorial of the duchess is included in Goethe's works under the title *Zum Andenken der Fürstin Anna-Amalia*.

AMALRIC or **AMAURI** or **BENA**, so called from his birthplace, a small village in the diocese of Chartres, was the founder of a school of pantheists known by his name. He lectured at Paris about the year 1200, and attracted a large circle of hearers. In 1204 his doctrines were condemned by the university; and on a personal appeal to Pope Innocent III. the sentence was ratified, Amalric being ordered to return to Paris and recant his errors. This he did in 1207. His death, two years later, was caused, it is said, by grief at the humiliation to which he had been subjected. In the same year (1209) ten of his followers were burnt before the gates of Paris, and Amalric's own body was exhumed and burnt, and the ashes given to the winds. The doctrines of the Amalricians were formally condemned by the fourth Lateran Council in 1215.

AMALTEO, the name of a family belonging to Oderzo, Treviso, several members of which were distinguished in literature. The best known are three brothers, Geronimo (1507–74), Giambattista (1525–73), and Cornelio (1539–1603), whose Latin poems were

published in one collection under the title *Trium Fratrum Amaltheorum Carmina*.

AMALTEO, POMPONIO, a painter of the Venetian school, was born at San Vito in Friuli in 1505, and died in 1584. His works consist chiefly of frescoes and altarpieces, and many of them have suffered greatly from the ravages of time.

AMARA SINHA, a Sanscrit grammarian and poet, of whose personal history hardly anything is known. He is said to have been "one of the nine gems that adorned the throne of Vikramaditya," and accordingly to have flourished about 56 B.C. Amara seems to have been a Buddhist; and an early tradition asserts that his works, with one exception, were destroyed during the persecution carried on by the orthodox Brahmins in the fifth century. The exception is the celebrated *Amara-Kosha* (Treasury of Amara), a vocabulary of Sanscrit roots, in three books, hence sometimes called *Trikanda*, or the "Tripartite." It contains 10,000 words, and is arranged, like other works of its class, in metre, to aid the memory.

AMARANTH, or AMARANT (from the Greek *ἀμάραντος*, unwithering), a name chiefly used in poetry, and applied to certain plants which, from not soon fading, typified immortality.

AMARAPURA, literally "the City of the Gods," a town of independent Burmah, situated on the east bank of the Irawadi river. The town was founded in 1783, and made the capital of the Burmese kingdom.

AMARI, MICHELE, born at Palermo, Sicily, July 7, 1806, published in 1841 a work on the "Sicilian Vespers," a masterpiece of historical criticism, which led to his exile. He returned in 1848 to take part in the revolution of that year, was again banished in 1849, but was recalled ten years later to become professor of Arabic, first at Pisa and afterward at Florence. In 1860 he fought under Garibaldi, became Senator in 1861, and later served as minister of public instruction. He has written largely on the early Mussulman settlements in Sicily.

AMARYLLIDEÆ, a natural order of petaloid monocotyledons, including many species distinguished for the beauty of their flowers. They are herbaceous plants, and most of them bulbous-rooted. There are some 400 species, natives principally of tropical and sub-tropical regions. Among them are the narcissus, amaryllis, snowdrop and snowflake.

AMASIA, or AMASIYAH, a town in Anatolia, Turkey, situated on both sides of the Yesil-Irmak, or Iris, in a narrow gorge about eighty miles from the mouth of the river. The chief productions of Amasia and the surrounding districts are silk, salt, wheat, wine, and cotton. Population of the town, 25,000.

AMASIS, king of Egypt, ascended the throne 569 B.C. From the rank of a common soldier he gradually rose to be one of the principal officers in the court of Apries, the last king of the line of Psammetichus. Being commissioned by Apries to quell an insurrection, he went over to the rebels, who proclaimed him king. The close of his reign was disturbed by the threatened invasion of Cambyses, king of Persia, and by the rupture of the alliance between Amasis and Polycrates of Samos. (See POLYCRATES.) Amasis, however, did not live to see the conquest of Egypt, for he died in 525, before the Persians had entered the country.

AMAT, FELIX, a Spanish ecclesiastical historian, was born at Sabadell, in the diocese of Barcelona, August 10, 1750. He died in a Franciscan convent near Salent on the 28th of September, 1824. Amat's chief work is his *Ecclesiastical History*, from the birth of Christ to the end of the eighteenth century.

AMATI, the name of a family of violin-makers who

flourished at Cremona from about 1550 to 1692. According to Fétis, Andrea and Nicolo Amati, two brothers, were the first Italians who made violins. They were succeeded by Antonio and Geronimo, sons of Nicolo. Another Nicolo, son of Geronimo, was alive in 1692. The violins made by this family are distinguished by their small size, exquisite finish, and the mathematical proportion of the parts. Their tone is soft and sweet, but deficient in intensity, owing to the flatness of their model. Stradivari was a pupil of the Amatis.

AMATITLAN, the name of a lake and town in Guatemala, Central America. The lake is 18 miles from the city of Guatemala, and is about 9 miles long and 3 broad. Population of town, 10,000, chiefly mulattoes and samboes.

AMAUROSIS, a deprivation of sight. The term is now limited chiefly to those forms of defect or loss of vision which are caused by diseases not directly involving the eye, although sooner or later the optic nerve undergoes changes recognisable by the ophthalmoscope. Sometimes the amaurosis is temporary, disappearing with the removal of the disease with which it is associated; but in many cases, more especially where the brain and spinal cord are affected, the amaurosis remains permanent.

AMAXICHI, a seaport town on the N. of the Ionian island of Santa Maura. It is the capital of the island, and the residence of a Greek archbishop.

AMAZON, MARANON, ORELLANA, or SOLIMOENS, a river of South America, the largest in the world. Its head stream is either the Ucayale or Apurimac, which rises in Peru or the more northerly Maraño, also called Tunguragua, which flows from Lake Lauricocha. The former is the larger river, but the latter has perhaps the weight of authority in its favor. The Maraño flows in a north-westerly direction, parallel to the Ucayale, as far as 6° S. lat., when it bends to the north-east, and, on reaching the frontiers of Ecuador, turns almost due east. It thence forms the boundary between Ecuador and Peru, with an easterly direction, until it joins the Ucayale. The united river continues to separate Ecuador and Peru as long as these countries are continuous, and thereafter strikes through Brazil, the general direction being north-north-east. It finally discharges itself into the Atlantic under the equator. From the source of the Apurimac to the ocean this mighty river has a length, including windings, of nearly 4000 miles. The breadth of the river, of course, varies at different points. At some distance below Jean, on the Maraño, it was found to be 860 feet wide; at a pass called the Pongo de Manseriche its bed is suddenly contracted from 250 to 25 fathoms, being enclosed on either side by rocks, which rise like perpendicular walls to a great height; at the junction with the Napo its breadth has increased to 900 fathoms. Between the Negro and the Madeira it has the breadth of a league, which extends to two leagues at those parts where islands abound; but during the annual rise of the water it covers a great part of the adjacent country, and has then no determinate limits. The main mouth is about 50 miles wide above the island of Caviána, but the whole delta, including the Para mouth and the island of Joannes, is nearly 200 miles from shore to shore. The depth of the Amazon in some parts exceeds 50 fathoms, and the river is navigable for vessels of the largest size up to the confluence of the Maraño and the Ucayale. The velocity of the water above San Borja so greatly exceeds the average (which is about 2½ miles an hour), that navigation becomes difficult, and among the rapids is impossible, even to canoes.

AMAZONS, a race of women represented in Greek legend as having lived in the north-east of Asia Minor, near the shore of the Black Sea, and as having there

formed an independent state, with a queen at its head, and with a mythical town of Themiscyra, on the river Thermodon, as its capital. From this centre they made warlike excursions, sometimes northward, but chiefly against the people on the coast of Asia Minor. From the traditions that to repel and conquer them was assigned as a task to Bellerophon by the King of Lycia, and again to Hercules by Eurystheus, it may be inferred that they were regarded by the Greeks at least as a permanent source of danger. But equally, if the task of conquering them is to be strictly compared with the other tasks in which these heroes were generally opposed to monsters and beings impossible in themselves, but possible as illustrations of permanent danger and damage, it would follow that the Amazons were mythical illustrations of the dangers which beset the Greeks on the coast of Asia Minor. Their impossibility as actual beings is further recognised in works of art, in which combats between them and Greeks are placed on the same level as, and often associated with, combats of Greeks and centaurs. The belief in the existence of the Amazons, however, having been once accepted and introduced into the national poetry and art, it became necessary to surround them as far as possible with the appearance of not unnatural beings. Their occupation was hunting and war; their arms the bow, spear, axe, a half shield, nearly in the shape of a crescent, called *pelta*, and in early art a helmet, the model before the Greek mind having apparently been the goddess Athene (Minerva). In later art they approach the model of Artemis (Diana), wearing a thin dress, girt high for speed; while on the later painted vases their dress is often peculiarly Persian — that is, close-fitting trousers, and a high cap called the *kidaris*. They fought partly on foot, partly on horseback, and always without quarter; so that the epithet of *oiorpata*, was applied to them. To maintain their stock, annual visits were paid to the neighboring peoples; and when, in consequence of this, children were born, the males were either sent over the borders or retained and brought up crippled, and in the condition of slaves, while the female children were assiduously trained to hunting and war.

AMBÁLA, a division, district, and city of British India, under the jurisdiction of the Lieutenant-Governor of the Panjáb.

AMBÁLA DISTRICT stretches N.W. and S.E. along the lower face of the Himálayas. It is bounded on the N.E. by the Himálayas, on the N.W. by the river Satlej, on the S.E. by the river Jamná, and on the S.W. by the district of Ludhiáná, the state of Patiálá, and the district of Karnál. The total area of the district is 2628 miles, or 1,681,930 acres, of which 945,526 acres are cultivated, 283,989 acres are cultivable, but not actually under tillage, and 452,415 acres are uncultivable and waste. The total population of the district, according to the census of 1889, amounts to 1,500,000 souls, divided into the following classes:—Hindus, 889,333; Mahometans, 586,874; Sikhs, 56,440; others, 2,841.

AMBALA CITY, the capital of the district of the same name, forms a large and important station on the Sind, Panjáb, and Delhi railway. Population, 50,000.

AMBARVALIA, or AMBAVALE SACRUM (*ambio* and *arzum*, to go round the field), an annual festival celebrated in ancient Rome on three days during the month of May. The private *ambarvalia* is to be distinguished from the *sacrificium deæ diæ* celebrated by the twelve *fratres arvales*, though the two festivals were coincident in point of time and had a common object, namely, to obtain from the gods a favorable harvest. The Christian festival that seems to have taken the place of the *ambarvalia* is the Rogation or *Gang Week* of the

Roman Catholic Church, for which the perambulation of the parish boundaries was substituted at the Reformation.

AMBASSADOR, a word introduced into the English language from Fr. *ambassadeur*, the Ital. *ambasciatore*, or the Span. *ambaxador*, which Wicquefort derives, perhaps without sufficient authority, from the Span. *embar*, to send. The word denotes a public minister of the highest rank, accredited and sent by the head of a sovereign state to a foreign court or country, with power to represent the person of the sovereign by whom he is sent, to negotiate with a foreign government, and to watch over the interests of his own nation abroad. The power thus conferred is contained in the credentials or letters of credence of which the ambassador is the bearer, and in the instructions under the sign-manual delivered to himself. The credentials consist in a sealed letter addressed by the sovereign in person whose representative he is, to the sovereign to whom he is sent, and they contain a general assurance that the sovereign by whom he is dispatched will approve and confirm whatever is done by the ambassador in his name.

Diplomatic envoys are of three ranks, as was finally determined by a common agreement of all the powers which was annexed to the final act of the treaty of Vienna in 1815:—1. Ambassadors; the ambassador of the pope being called a nuncio, and the ambassador of the Emperor of Austria to the Sublime Porte being called his inter-nuncio. These only have representative rank. 2. Envoys extraordinary or ministers plenipotentiary, accredited to sovereigns (*auprès des souverains*). 3. Chargés d'affaires, who are only entitled to transact business with the Minister of Foreign Affairs. We shall confine ourselves in this article to the diplomatic officers of the first rank. The Queen of England has embassies at Paris, Constantinople, Vienna, St. Petersburg, and Berlin. The number of British ministers plenipotentiary are twenty-three, and three chargés d'affaires; but these numbers vary. The United States Government sends out no ambassadors, their diplomatic agents being confined to the rank of ministers plenipotentiary and chargés d'affaires. The ministers are recipients of all courtesies due to accredited representatives of the government, while at the same time the government to whom they are sent has the right of rejection, as was recently done by Italy in the case of Mr. Keiley.

From the 15th century, when the practice of sending resident embassies may be said to have commenced in Europe, down to the close of the 18th century, these missions were surrounded with a prodigious amount of splendor, ceremonial, and ostentatious dignity. British ambassadors were commonly sent out till within the last thirty years in ships of war. The ambassador represented a monarch, and was to play the part of one. The memoirs of those ages are full of the magnificence and profuse display which marked their progress — lacqueys, liveries, state coaches, led horses, and all the pageantry of state. Fierce disputes frequently arose between rival ambassadors for precedence; sometimes these disputes even extended to the courts and ministers to whom these envoys were dispatched as messengers of peace, and a vast deal of time was lost (especially at the Congress of Münster) in adjusting them. On the part of the sovereign to whom they were to present their credentials the same display was made. The ambassador had the right to stand covered in the presence of royalty. At Venice the doge placed Sir Harry Vane, covered and seated, on his right hand in the Council of Ten. A speech was then delivered, in which the ambassador declared the friendly sentiments of his own sovereign, and his own humble desire to give effect to them.

Modern simplicity and the facility of intercourse has swept away many of these formalities. Traces of them survive at the courts of Berlin and Vienna, but elsewhere an ambassador is presented with little more than the customary ceremony of a court. It has long been held that every state is at liberty to receive ambassadors with or without ceremony, just as it pleases, provided they are all treated alike.

Every state or sovereign has the right, if it thinks fit, to refuse to receive a particular person as an ambassador, or even to receive any ambassador at all. It is therefore customary to ascertain beforehand whether the person designated for an embassy is favorably regarded and will be well received. There have been instances, not very remote, of unfavorable answers or refusals to receive given individuals.

The rank of an ambassador, as regards the society of the nation to which he is accredited, places him immediately after the princes of the blood royal, because he represents a sovereign power, and this rank is universally conceded to him.

The first right of an ambassador is that of personal audience of the sovereign. His credentials must invariably be presented to the sovereign in person, and he may ask for an audience on any fitting occasion. In England, however, the sovereign does not officially receive an ambassador except in the presence of one or more of the ministers of the crown.

In all ages the perfect personal security of persons invested with high diplomatic functions, as the representatives of a foreign power, has been an essential and fundamental principle of the law of nations. Indeed it was the law of nations when there was no other. Alexander the Great destroyed Tyre for an insult offered to his ambassador; and it stands recorded in the Roman law, "*Si quis legatum hostium pulsasset, contra jus gentium id commissum esse existimatur, quia sancti habentur legati.*" In moments of excessive excitement or revolutionary frenzy even this principle has been violated, as in the murder of Dr. Dorislaus at the Hague (1649), and of the French envoys at Rastadt (1799); but such acts leave an indelible disgrace on those who have committed them. To secure this immunity from all interference, an accredited ambassador or envoy is wholly free from the jurisdiction of the courts of law, or of any other authority in the country in which he is sent to reside. This constitutes the doctrine of *extraterritoriality*. His house is as sacred as his person. It is supposed, like a ship at sea, to form a part of the territory represented by the flag which he may hoist over it. All the members of the embassy, and even the servants of the ambassador, share the same inviolability. They cannot even be arrested and prosecuted for offenses without his consent.

An ambassador or envoy pays no taxes or contributions to the public revenue of the country in which he resides, and on this principle he is entitled to receive commodities from abroad free of custom duties. But he is not exempted from the payment of local rates, — though, indeed, if he were to decline to pay them, no process could issue against him for the purpose of levying them. He also pays the ordinary rates of postage, but he has the privilege of sending his own couriers carrying sealed despatches, which exempts him from the monopoly of the post office. These couriers, and their despatches or mails, are also regarded by common consent as inviolable messengers, unless they chance in time of war to fall into the hands of a hostile belligerent. In some countries ambassadors and their couriers have been allowed to have a prior claim for post horses over private travellers.

Another of the important privileges of an ambassador

or envoy is the free exercise of the religion or form of worship to which he adheres; but it is laid down by the best writers on the subject that a foreign minister has not the right of maintaining a chapel or chaplain within his hotel, under the law of nations; hence the liberty of religious worship for the ambassador and his suite was made a matter of treaty engagement between Catholics and Protestants, and between Christian and Mussulmans.

We now pass to the duties of an ambassador, and we place at the head of them that of keeping his own sovereign well informed of all that may concern his interests in foreign countries. He is the eye of the government he serves, specially directed to a particular spot, and he ought to be thoroughly acquainted with the course of policy, the movements of parties, the character and disposition of individual statesmen, and the material and commercial resources of the country in which he resides. His public despatches, and his private correspondence with the Minister of Foreign Affairs under whom he serves, ought to be a record of all that can interest or concern the state which he represents. In this sense the diplomatic reports of the ambassadors of former times are invaluable materials for history. His next duty is to protect and defend, if necessary, the persons and interests of his fellow-countrymen abroad; and this is of especial moment in the case of a British ambassador, whose countrymen are to be met with as travellers, navigators, or merchants in all parts of the globe. To them the presence and influence of the diplomatic representatives of the country is of incalculable value, and nothing can be more ill-judged than the proposals that have been made to cut down and contract our foreign embassies and missions. A third, but not less important, duty of an ambassador is to maintain the most amicable relations with the sovereign to whom he is accredited, and with his ministers, and to observe towards them the strictest respect, veracity and good-will. It has been said in joke that the first duty of an ambassador is to keep a good cook; but if this implies that he is to exercise a liberal hospitality and to make his house agreeable, those no doubt are means which may powerfully assist him in the objects of his mission. The first, perhaps we ought to say the sole duty, of an ambassador is to protect his own national interests and to promote the most friendly relations with the sovereign to whom he is accredited; and experience has proved that these objects are best secured by confining himself to the principal objects of his mission, and by relying on no arts but those of sincerity, forbearance, and truth.

AMBATO, or ASIENTO D'AMBATO, a town of Ecuador, on the northern slope of Chimborazo, about 65 miles south of Quito, 8859 feet above the sea.

AMBER (Lat. *Succinum, Electrum*; Fr. *Succin, Ambre*; Ger. *Berstein*) is a hard, brittle substance with a resinous lustre, sometimes found perfectly transparent, but more usually of varying degrees of translucency, and possessing a prevailing yellow color, passing from a pale straw tint to a deep orange. It occurs in irregular masses, and has neither taste nor, at ordinary temperatures, odor. It develops electrical phenomena by friction, a property which doubtless early drew attention to amber, and invested it with the romantic interest which attached to it in ancient times. The popular regard for the substance among the nations of antiquity was further maintained by the fabulous tales of the manner in which amber was formed and the mystery connected with its occurrence.

The earliest notice of amber we find occurs in the *Odyssey* of Homer, where in the list of jewels offered by Phœnician traders to the Queen of Syra occurs "the gold necklace hung with bits of amber" (*Od.* xv. 640). Thales of Miletus, 600 B.C., noticed that

amber when rubbed attracted light bodies, and that remote and simple observation is the foundation of the modern science of *electricity*. Among the Greek fables purporting to account for the origin of amber, it is narrated that the Heliadæ, on seeing their brother Phæthon hurled by the lightning of Jove into the Eridanus, were by the pitying gods transformed into poplar trees, and the tears they shed were dropped as amber on the shores of the river.

The great source of supply of amber in all ages appears to have been the Baltic coasts, from which the supplies of commerce still continue to be drawn. During the reign of Nero an expedition was sent from Rome to explore the amber-producing country, and so successful was the party that a present of 13,000 lb. of amber was brought back to the emperor, including a piece weighing 13 lb. It occurs in regular veins along the Baltic coast, but in greatest abundance between Pillau and Grosz Hubenicken, on the Prussian coast.

After heavy storms large quantities are usually found thrown up on the coast at the localities where it is regularly excavated, and the assumption is, that amberiferous deposits crop up in the shallow waters near the shores, from which pieces become detached during the violent commotion of the water. It is further sparingly cast on the Swedish and Danish coasts, and occasionally pieces are picked up along the shores of Norfolk, Essex, and Sussex in England. It occurs at numerous localities inland throughout Europe, among which may be noted the neighborhood of Basle in Switzerland, the departments of Aisne, Loire, Gard, and Bas Rhine in France, and in the Paris clay it is associated with bituminous deposits. In England it has been found in the sandy deposits of the London clay at Kensington. The coasts of Sicily and the Adriatic likewise afford amber. The most beautiful specimens are perhaps those which are found at Catania. They often possess a beautiful play of color, approaching to purple, not to be observed in the product of other places. Professor Dana gives the following note on its occurrence in America:—

“It has been found in various parts of the greensand formation of the United States, either loosely embedded in the soil or engaged in marl or lignite, as at Gay Head or Martha's Vineyard, near Trenton, and also at Camden, in New Jersey, and at Cape Sable, near Magothy river, in Maryland.”

It is said to be taken in large quantities from the north of Burmah to the markets of China, where it is highly prized.

The appearance of enclosed foreign bodies, such as insects, leaves, twigs, &c., which amber very often presents, and the markings on its surface, very early led to correct inferences as to its origin. Pliny states that “amber is an exudation from trees of the pine family, like gum from the cherry and resin from the ordinary pine; and in accordance with this opinion is its Latin name *succinum*, the gum-stone.” The opinion expressed by Pliny is that which at the present day may be fairly held as established; but of course amber differs from other resins owing to changes induced by its fossilised condition.

The close relation of amber to ordinary resins is further brought out by its chemical properties and composition. According to Berzelius, it consists mainly of a resin, succinite, insoluble in alcohol, in combination with small proportions of two others, isomeric with the first, but soluble in alcohol and ether.

The value of amber depends upon its color, its lustre, and its size. In 1576 a mass weighing 11 lb. was found in Prussia, and deemed worthy of being presented to the emperor; later, a mass of 13 lb. was found, for which it is said 5000 dollars were refused. In the royal cabinet

at Berlin a piece is shown weighing 18 lb.; but such masses are of very great rarity.

AMBERG, a walled town of Bavaria, formerly the capital of the Upper Palatinate, and at present the seat of the appeal court for the district, is situated on both sides of the Vils, 35 miles east of Nuremberg. The French under Jourdan were defeated by the Austrians near Amberg in 1796. Population in 1889, 16,705.

AMBERGRIS (*Ambrâ grisea*, *Ambre gris*, or Grey Amber) is a solid, fatty, inflammable substance of a dull grey or blackish color, the shades being variegated like marble, possessing a peculiar sweet earthy odor. It is now known to be a morbid secretion formed in the intestines of the spermaceti whale (*Physeter macrocephalus*), and is found floating upon the sea, on the sea-coast, or in the sand near the sea-coast. It is met with in the Atlantic Ocean, on the coasts of Brazil and Madagascar; also on the coast of Africa, of the East Indies, China, Japan, and the Molucca Islands; but most of the ambergris which is brought to England comes from the Bahama Islands, Providence, &c. It is also sometimes found in the abdomen of whales, always in lumps in various shapes and sizes, weighing from $\frac{1}{2}$ oz. to 100 or more lb. A piece which the Dutch East India Company bought from the King of Tydore weighed 182 lb. An American fisherman from Antigua found, inside a whale, about 52 leagues south-east from the Windward Islands, a piece of ambergris which weighed about 130 lb. and sold for about \$2,500. The true source and character of ambergris were first satisfactorily established by Dr. Swediaur in a communication to the Royal Society (*Philosophical Transactions*, vol. lxxiii.) It was found by Dr. Swediaur that ambergris very frequently contained the horny mandibles or beaks of the squid (*Sepia moschata*), on which sperm whales are known to feed. That observation, in connection with the fact of ambergris being frequently taken from the intestines of the sperm whale, sufficiently proved that it was formed within that creature, and not an extraneous subject swallowed by the whale. It was further observed that the whales in which ambergris was found were either dead or much wasted and evidently in a sickly condition.

AMBERT, chief town of an arrondissement of the same name in the department of Puy de Dôme, France, situated on the Dore, thirty-five miles from Clermont.

AMBLESIDE, a small market town in Westmoreland, situated about a mile from the head of Lake Windermere, and fourteen miles from Kendal. Coarse woolen cloths are manufactured. Population, 2,000.

AMBLETEUSE, a seaport town of France, in the department of the Pas de Calais, on the English Channel, six miles north of Boulogne. It possesses an historical interest as the landing place of James II. after his abdication in 1688; and Napoleon I. in 1804 attempted to improve the harbor for flat-bottomed boats by means of which he was to evade England. Near Ambleteuse is the column which he erected to the grand army in 1805.

AMBLYOPSIS, a bony fish found in the streams of the Mammoth Cave of Kentucky, and interesting as illustrating in the rudimentary condition of its eyes the effects of darkness and consequent disuse of those organs.

AMBO, or AMBON, a reading-desk or pulpit in early Christian churches which was placed in the middle of the nave. The purposes of the ambo were served in mediæval churches by the rood-loft, a gallery across the chancel-arch, and in modern churches it has given place to the lectern and the pulpit.

AMBOISE, a town situated in a rich wine-producing district in the department of Indre-et-Loire, France, on the left bank of the Loire, 14 miles east of Tours. At Amboise the French Protestants were first called

Huguenots, and 1200 of them were massacred there in 1560.

AMBOYNA, one of the Moluccas or Spice Islands, belonging to the Dutch, lying south-west of Ceram. It is 32 miles in length, with an area of about 280 square miles, and is of very irregular figure, being almost divided into two. The south-eastern and smaller portion (called Letimor) is united to the northern (known as Hitoe) by a neck of land about a mile broad. The island is mountainous, but is for the most part fertile and well-watered. Large tracts are covered with rich tropical forests, which embrace a great variety of trees, although ordinary building timber is scarce. In 1654, after many fruitless negotiations, Cromwell compelled the United Provinces to give the sum of £300,000, together with a small island, as compensation to the descendants of those who suffered in the "Amboyna massacre." In 1796 the British, under Admiral Rainer, captured Amboyna, but restored it to the Dutch at the peace of Amiens in 1802. It was recaptured by the British in 1810, but once more restored to the Dutch in 1814. Population, about 50,000. See **MOLUCCAS**.

AMBOYNA, the chief town of the above island, and also of the Dutch Moluccas, is situated towards the north-west of the peninsula of Letimor.

AMBRACIA, or **AMPRACIA**, an important city of ancient Epirus, situated on the eastern bank of the river Arachthus, about seven miles from the Ambracian Gulf. According to tradition, it was originally a Thesprotian town, founded by Ambrax, son of Thesprotus, or by Ambracia, daughter of Augeas. About 635 B.C. it was colonised by Corinthians, and so became a Greek city. Its power decreased rapidly until the time of the Peloponnesian war, when it commanded the whole of Anphilochia, including the town of Argos, from which the original inhabitants were expelled. In 432 B.C. the expelled citizens, with the assistance of the Athenians under Phormion, retook Argos. In 430 the Ambracians made an unsuccessful attempt to recover the town, and a second attack in 426 resulted in a still more disastrous failure. The site of Ambracia is occupied by the modern Arta, near which remains of the ancient fortifications may be seen.

AMBROSE OF ALEXANDRIA lived in the beginning of the third century. According to some, Ambrose died a martyr in the persecution under Maximin, about the year 236; but the dedication of Origen's *Eight Books against Celsus* proved that he lived to the year 250, or near that period. Origen speaks of him as a man of sincere piety, and much devoted to the study of the Scriptures.

AMBROSE, SAINT, Bishop of Milan, was one of the most eminent fathers of the church in the fourth century. He was a citizen of Rome, born in Gaul,—according to some historians, in the year 334, but according to others in 340. At the period of his birth his father was prætorian prefect of Gallia Narbonensis; and upon his death the widow repaired to Rome with her family. Ambrose received a religious education, and was reared in habits of virtue by his mother, an accomplished woman, and eminent for her piety.

The death of Auxentius, bishop of Milan, in the year 374, made a sudden change in the fortune and literary pursuits of Ambrose. At that period the tide of religious contention ran high between the orthodox and the Arians, and a violent contest arose concerning the choice of a successor to Auxentius. When the people were assembled in the church to elect the new bishop, Ambrose, in the character of governor of the place, presented himself to the assembly, and in a grave, eloquent, and pathetic address, admonished the multitude to lay aside their contentions, and proceed to the

election in the spirit of religious meekness. It is reported that when Ambrose had finished his address, a child cried out, "Ambrose is bishop," and that the agitated multitude, regarding this as a miraculous intimation, unanimously elected Ambrose bishop of Milan.

The irruption of the Goths and the northern barbarians, who rushed down upon the Roman empire at this time, spreading terror and desolation all around, compelled Ambrose, along with several others, to retire to Illyricum, but his exile was of short duration, for the northern invaders were quickly defeated by the forces of the emperor, and driven back with considerable loss into their own territories.

The eloquence of Ambrose soon found ample scope in the dispute between the Arians and the orthodox. About this era the doctrine of Arius concerning the person of Christ had been extensively received, and had many powerful defenders both among the clergy and the common people. Ambrose espoused the cause of the Catholics. Gratian, the son of the elder Valentinian, took the same side; but the younger Valentinian, who had now become his colleague in the empire, adopted the opinions of the Arians; and all the arguments and eloquence of Ambrose were insufficient to reclaim the young prince to the orthodox faith. Theodosius, the emperor of the East, also professed the orthodox belief; but there were many adherents of Arius scattered throughout his dominions. In this distracted state of religious opinion, two leaders of the Arians, Palladius and Secundianus, confident of numbers, prevailed upon Gratian to call a general council from all parts of that empire. This request appeared so equitable that he complied without hesitation; but Ambrose, foreseeing the consequence, prevailed upon the emperor to have the matter determined by a council of the Western bishops. A synod, composed of thirty-two bishops, was accordingly held at Aquileia, in the year 381. Ambrose was elected president; and Palladius being called upon to defend his opinions, declined, insisting that the meeting was a partial one, and that the whole bishops of the empire not being present, the sense of the Christian church concerning the question in dispute could not be obtained. A vote was then taken, when Palladius and his associate Secundianus were deposed from the episcopal office.

Ambrose was equally zealous in combating the heathen superstitions. Upon the accession of Valentinian II., many of the senators who remained attached to the pagan idolatry made a vigorous effort to restore the worship of the heathen deities. Symmachus, a very opulent man and a great orator, who was at that time prefect of the city, was entrusted with the management of the pagan cause, and drew up a forcible petition, praying for the restoration of the altar of Victory to its ancient station in the hall of the senate, the proper support of seven vestal virgins, and the regular observance of the other pagan ceremonies. In the petition he argued that this form of religion had long been profitable to the Roman state, and reminded the emperor how much Rome had been indebted to Victory, and that it had been the uniform custom of the senators to swear fidelity to the government upon that altar. To this petition Ambrose replied in a letter to Valentinian, arguing that the devoted worshippers of idols had often been forsaken by their deities; that the native valor of the Roman soldiers had gained their victories, and not the pretended influence of pagan priests; that these idolatrous worshippers requested for themselves what they refused to Christians; that voluntary was more honorable than constrained virginity; that as the Christian ministers declined to receive temporal emoluments, they should also be denied to pagan priests; that

it was absurd to suppose that God would inflict a famine upon the empire for neglecting to support a religious system contrary to His will as revealed in the Scriptures; that the whole process of nature encouraged innovations, and that all nations had permitted them, even in religion; that heathen sacrifices were offensive to Christians; and that it was the duty of a Christian prince to suppress pagan ceremonies. In the epistles of Symmachus and of Ambrose both the petition and the reply are preserved, in which sophistry, superstition, sound sense, and solid argument are strangely blended. It is scarcely necessary to add that the petition was unsuccessful.

The increasing strength of the Arians proved too formidable for Ambrose. In 384 the young emperor and his mother Justina, along with a considerable number of clergy and laity professing the Arian faith, requested from the bishop the use of two churches, one in the city, the other in the suburbs of Milan. The prelate believing the bishops to be the guardians both of the temporal and spiritual interests of the church, and regarding the religious edifices as the unquestionable property of the church, positively refused to deliver up the temples of the Lord into the impious hands of heretics. Filled with indignation, Justina resolved to employ the imperial authority of her son in procuring by force what she could not obtain by persuasion. Ambrose was required to answer for his conduct before the council. He went, attended by a numerous crowd of people, whose impetuous zeal so over-awed the ministers of Valentinian that he was permitted to retire without making the surrender of the churches. The day following, when he was performing divine service in the Basilica, the prefect of the city came to persuade him to give up at least the Portian church in the suburbs. As he still continued obstinate, the court proceeded to violent measures: the officers of the household were commanded to prepare the Basilica and the Portian churches to celebrate divine service upon the arrival of the emperor and his mother at the ensuing festival of Easter. Perceiving the growing strength of the prelate's interest, the court deemed it prudent to restrict its demand to the use of one of the churches. But all entreaties proved in vain, and drew forth the following characteristic declaration from the bishop:—"If you demand my person, I am ready to submit: carry me to prison or to death, I will not resist; but I will never betray the church of Christ. I will not call upon the people to succor me; I will die at the foot of the altar rather than desert it. The tumult of the people I will not encourage; but God alone can appease it."

Although the court was displeased with the religious principles and conduct of Ambrose, it respected his great political talents; and when necessity required, his aid was solicited and generously granted. When Maximus usurped the supreme power in Gaul, and was meditating a descent upon Italy, Valentinian sent Ambrose to dissuade him from the undertaking; and the embassy was successful. On a second attempt of the same kind Ambrose was again employed; and although he was unsuccessful, it cannot be doubted that, if his advice had been followed, the schemes of the usurper would have proved abortive; but the enemy was permitted to enter Italy, and Milan was taken. Justina and her son fled; but Ambrose remained at his post, and did good service to many of the sufferers by causing the plate of the church to be melted for their relief. Theodosius, the emperor of the East, espoused the cause of Justina, and regained the kingdom.

The generosity of Ambrose was favorably exhibited in the year 392, after the assassination of Valentinian and the usurpation of Eugenius. Rather than join the stand-

ard of the usurper, he fled from Milan; but when Theodosius was eventually victorious, he supplicated the emperor for the pardon of those who had supported Eugenius. Soon after acquiring the undisputed possession of the Roman empire, Theodosius died at Milan (395). Bishop Ambrose did not long survive him, having died in the year 397.

For a description of the famous church of St. Ambrose, founded by him at Milan 387 A.D., see MILAN. For the Ambrosian Library, see LIBRARIES. Notices of his LITURGY and HYMNS will be found under these headings.

AMBROSE, ISAAC, a Puritan divine. Formerly the practical and devotional writings of this eminent Nonconformist rivalled John Bunyan's in popularity, and his *Looking to Jesus* holds its own even now. Prominent name as his was in his generation, very scanty are the personal memorials of him. His own "Media," under the head of "experiences," yields a few incidents of his life. He entered Brazenose college, Oxford, in 1621, in the seventeenth year of his age, and must therefore have been born in 1603-4. Having taken his M.A. and been ordained, he received at the outset a little cure in Derbyshire, which was at that time and onward to Puritanism what Goshen was to Egypt and Israel. By the influence of the Earl of Bedford, he was appointed one of the king's itinerant preachers in Lancashire. Having later served for a time a curacy in Garstang, he was selected by the Lady Margaret Houghton as vicar of Preston. He was on the celebrated committee for the ejection of "scandalous and ignorant ministers and schoolmasters" during the Commonwealth. He was vicar of Garstang when the Act of Uniformity was passed. He could have conscientiously complied with many of its requirements, for he was willing to use the Prayer book, and did not stickle at things whereat other tender consciences did; but the enforcement was so absolute, not to say brutal, that he found himself constrained to form one of the Two Thousand. His after years were passed among old friends at Preston. He died in 1664 at the age of sixty-one. Calamy says he was seventy-two, but his college entry shows he was mistaken. As a religious writer, Ambrose has a vividness and freshness of imagination possessed by scarcely any of the Puritan Nonconformists. He is plaintive as Flavel and as intense as Baxter. Many who have no love for Puritan doctrine, nor sympathy with Puritan experience, have appreciated the pathos and beauty of his writings, which have never been out of print from their original issue until now.

AMBROSIOUS, AURELIANUS, a leader of the Britons during the 5th century. He is said, on somewhat doubtful authority, to have been a son of Constantine, who was elected emperor by the Roman army in Britain in 407. The usually received account of his life, based chiefly upon the history of Geoffrey of Monmouth, contains much that is evidently fabulous. The circumstances of his death are involved in equal obscurity. According to Geoffrey's account, he died of poison at Winchester; but others state that he was killed in a battle with Cedric the Saxon in 508.

AMBULANCE, the French *ambulance*, *hôpital ambulant*, derived from the Latin *ambulare*, to move from place to place.

Ambulances, in military phraseology, are hospital establishments moving with armies in the field, and organised for providing early surgical assistance to the wounded after battles. They are only prepared for affording help of a more or less temporary kind, and they are thus distinguished from the *stationary or fixed hospitals*, in which sick and wounded soldiers receive care and treatment of a permanent character. The

term is not unfrequently applied in common speech in England to the ambulance waggons, or other conveyances by which the wounded are carried from the field to the ambulances and fixed hospitals.

The origin of the ambulance system which now prevails in all civilised armies, though variously modified among them in particular details, only dates from the last decade of the last century. Before that time no ambulance establishments had been organised for effecting the removal of the wounded, or for giving the requisite surgical attention to them, while battles were in progress. Soldiers wounded in the ranks were either carried to the rear by comrades, or were left to lie exposed to all risks, and unheeded, until after the fighting had ceased. The means of surgical assistance did not reach the battle-field till the day after the engagement, or often later, and to a large proportion of the wounded it was then of no avail. In 1792 Larrey introduced his system of *ambulances volantes*, or flying field hospitals, establishments capable of moving from place to place with speed, like the flying artillery of the time. They were adapted both for giving the necessary primary surgical help, and also for removing the wounded quickly out of the sphere of fighting. The first Napoleon warmly supported Larrey in his endeavors to introduce and perfect the new system of surgical aid to the wounded in battle; and, being received with much favor by the troops, the plan obtained a firm footing, and was subsequently brought to a high state of perfection. About the same time another distinguished surgeon of high position in the French army, Baron Percy, introduced and developed a corps of *brancardiers*, or stretcher-bearers. These consisted of soldiers trained and regularly equipped for the duty of collecting the wounded while a battle was in progress, and carrying them on stretchers to places where means of surgical aid were provided.

From the period when these improvements were introduced most civilised armies have had ambulance establishments formed for giving surgical help near to the combatants. It is only, however, during the last twenty years that ambulances have acquired the completeness of organisation which they have now attained in some armies, especially in those of Germany. In the armies of the United States of America, during the late great civil war, the ambulance system attained a very complete organisation, particularly from March 1864, when an Act was passed by Congress, entitled "An Act to establish a uniform system of Ambulances in the United States." This law fixed a definite and single system of ambulance arrangements for all the armies of the United States at that time in the field.

One important step, taken a few years since, towards the amelioration of the condition of the wounded of armies in the field must be just mentioned. This was the European Convention signed at Geneva in 1864, by the terms of which, subject to certain regulations, not only the wounded themselves, but the official staff of ambulances and their equipment have been rendered neutral; the former, therefore, not being liable to be retained as prisoners of war, nor the latter to be taken as prize of war. This convention has greatly favored the development of ambulance establishments.

The conditions of modern warfare have led to the need of army ambulances being arranged on principles different from what were applicable only a few years ago. The immensely increased range of rifles and artillery in the present day, the consequent extension of the area over which fire is maintained, the suddenness with which armies can be brought into the field from increased facilities of locomotion, the rapidity of their movements, the shortened duration of campaigns, the

large numbers of wounded which have to be dealt with, not merely from the destructive qualities of the fire-arms, but from the vast forces collected on occasions of important battles, the increased proportion of severe wounds,—are all circumstances which have entailed need for revision of ambulances and their administration. The ambulances must be so organized as to be able to keep up with the troops, and so disposed as in no way to interfere with their movements.

Ambulance arrangements have to be modified to suit particular military operations, such as when troops disembark on a hostile shore, on occasion of sieges, etc.

AMBUSCADE, a manœuvre in warfare whose nature is indicated by the derivation of the word from the Italian *imboscata* ("concealed in a wood"), and now applied to any attempt to attack an enemy by lying in wait and coming upon him unexpectedly.

AMELOT DE LA HOUSAYE, ABRAHAM NICOLAS, historian and publicist, was born at Orleans, France, in 1634, and died at Paris, December 8, 1705. Amelot published translations of Machiavel's *Prince*, and of the *Annals* of Tacitus, besides other works.

AMELOTTE, DENIS, a French ecclesiastic and author, was born at Saintes in Saintonge in 1606, and died October 7, 1678. In 1643 he published a *Life of Charles de Goudren*, second superior of the congregation, which, by some of its remarks on the famous abbot of St. Cyran, gave great offense.

AMENDMENT, in judicial proceedings, means the correction of any errors or the supplying of any omissions in the record of a civil action or criminal indictment.

AMENDMENTS, CONSTITUTIONAL. Changes in the constitution of the United States are provided for by Article V. of the Constitution. (See section, page 6035.) The first ten amendments were adopted in 1791 and are usually looked on as a part of the original organic law. In all, fifteen amendments have been adopted. Amendments to the State constitutions are in most instances adopted by both branches of the legislature (sometimes by two successive legislatures) and then submitted to the people.

AMERICA. Our object in this article is to take a comprehensive survey of the two continents which constitute America in their physical, moral and political relations. In attempting this, we shall dwell at some length upon those great features and peculiarities which belong to America as a whole, or facts which can be most advantageously considered in connection with one another. The new continent may be styled emphatically "a land of promise." Great as is its present it derives its greatest importance from the germs it contains of a mighty future.

The new continent, when compared with the old, enjoys three important advantages. First, it is free from such vast deserts as cover a large part of the surface of Asia and Africa, and which not only withdraw a great proportion of the soil from the use of man, but are obstacles to communication between the settled districts, and generate that excessive heat which is often injurious to health, and always destructive to industry. Secondly, no part of its soil is so far from the ocean as the central regions of Asia and Africa. Thirdly, the interior of America is penetrated by majestic rivers, the Mississippi, Amazon and Plata, greatly surpassing those of the old continent in magnitude, and still more in the facilities they present for communication with the sea.

GENERAL FEATURES OF THE TWO CONTINENTS.

In the physical formation of North and South America there is a remarkable resemblance. Both are



CENTRAL AMERICA

SCALE OF MILES

Submarine Cables
Railroads
Size of type indicates relative importance of places

Hammond's 8 x 11 Map of Central America
Copyright, 1904, by C.S. Hammond & Co., New York

very broad in the north, and gradually contract toward the south till they end, the one in a narrow isthmus, and the other in a narrow promontory. Each has a lofty chain of mountains near its western coast, abounding in volcanoes, with a lower ridge on the opposite side, destitute of any recent trace of internal fire; and each has one great central plain declining to the south and the north, and watered by two gigantic streams, the Mississippi corresponding to the Plata, and the St. Lawrence to the Amazon. In their climate, vegetable productions and animal tribes, the two regions are very dissimilar. The northern half stretches from the Arctic regions to the Tropic of Cancer, while the southern extends from ten degrees north to fifty south.

The extent of the American continent and the islands connected with it is as follows:

	Sq. miles.
North America.....	8,109,199
South America.....	7,756,988
Islands.....	95,551
Total.....	15,962,738

The American continent, therefore, with its dependent islands, is four times as large as Europe, and about one-third larger than Africa, but somewhat less than Asia, while it is nearly five times the size of the Australian continent. It constitutes about three-tenths of the dry land on the surface of the globe. It is characterized by having a greater length from north to south than any other continent; and by the northern and southern portions being connected by a comparatively narrow strip of land. South America has a more regular form, and as a mass is situated much farther in the east than North America. In South America the most central point lies in about 58° W.; but in North America the most central point would be in about 100° W. As regards continuity of land, America comprises some islands at the southern end; a main continental portion, including South America, Central America, and North America; some islands off the north shore, and many other islands along the east and west coasts, those on the east being the most important. The most northern point of the mainland is that of Boothia Felix, in Bellot Strait, 71° 55' N., 92° 25' W. The islands to the north extend beyond 82° 16' N., 65° W., which point was reached by the *Polaris* in August, 1871. The southernmost point of the mainland is Cape Froward, which lies close to 54° S., 71° W.; while Cape Horn, the most southern point of the islands, is in 56° S., 67° 20' W. The extreme points traced are consequently 138° apart, and the continental part stretches over about 126 degrees of latitude. This corresponds to lengths of 8,280 and 7,560 geographical miles respectively. The extreme east points of the continent are Cape St. Roque, in 5° 28' S., 35° 40' W., in South America, and Cape St. Charles, in 52° 17' N., 55° 35' W. in North America. The most western point of South America is Point Parina, in 4° 40' S., 81° 10' W.; and of North America Prince of Wales Cape, in 65° 30' N., 167° W. The greatest breadth of North America is between Cape Lisburne and Melville Peninsula; and of South America, between Pernambuco and Point Aguja. The narrowest part is 28 miles, at the Isthmus of Panama. The nearest approach to the Old World is at Behring Strait, which is 48 miles across, and shallow. On the east side the nearest point to the Old World is Cape St. Roque, which is opposite the African coast at Sierra Leone. Greenland is separated from the archipelago of Arctic America by a deep and broad sea, and seems to belong to the European rather than the American area.

North America, with the general form of a triangle, naturally divides itself into five physical regions: 1. The tableland of Mexico, with the strip of low country on its eastern and western shores; 2. The plateau lying between the Rocky Mountains and the Pacific Ocean, a country with a mild and humid atmosphere as far north as the 55th parallel, but inhospitable and barren beyond this boundary; 3. The great central valley of the Mississippi, rich and well wooded on the east side; bare but not unfertile in the middle; dry, sandy, and almost a desert on the west; 4. The eastern declivities of the Alleghany Mountains, a region of natural forests, and of mixed but rather poor soil; 5. The great northern plain beyond the 50th parallel, four-fifths of which is a bleak and bare waste, over-spread with innumerable lakes, and resembling Siberia both in the physical character of its surface and the rigor of its climate.

South America is a peninsula likewise of triangular form. Its greatest length from north to south is 4,550 miles; its greatest breadth 3,200; and it covers an area as already mentioned, of 7,756,988 square miles, about three-fourths of which lie between the tropics, and the other fourth in the temperate zone. From the configuration of its surface, this peninsula also may be divided into five physical regions: 1. The low country skirting the shores of the Pacific Ocean, from 50 to 150 miles in breadth, and 4,000 in length. The two extremities of this territory are fertile, the middle a sandy desert. 2. The basin of the Orinoco, a country consisting of extensive plains or *steppes*, called llanos, either destitute of wood or merely dotted with trees, but covered with a very tall herbage during a part of the year. During the dry season the heat is intense here, and the parched soil opens into long fissures, in which lizards and serpents lie in a state of torpor. 3. The basin of the Amazon, a vast plain, embracing a surface of more than two millions of square miles, possessing a rich soil and humid climate. It is covered almost everywhere with dense forests, which harbor innumerable tribes of wild animals, and are thinly inhabited by savages, who live by hunting and fishing. 4. The great southern plain, watered by the Plata and the numerous streams descending from the eastern summits of the Cordilleras. Open *steppes*, which are here called pampas, occupy the greater proportion of this region, which is dry, and in some parts barren, but in general is covered with a strong growth of weeds and tall grass, which feeds prodigious herds of horses and cattle, and affords shelter to a few wild animals. 5. The country of Brazil, eastward of the Parana and Uruguay, presenting alternate ridges and valleys, thickly covered with wood on the side next the Atlantic, and opening into steppes or pastures in the interior.

The mountains of North and Central America will not detain us long. The ranges of Central America have no relation to the Andes, differing from them both as regards age and direction, which is generally N. 55° W., and being separated from them by gaps only a few hundred feet above the sea, and upwards of 100 miles wide. During the Tertiary period the mountains of North and South America had still less connection than at present, for where the isthmus now forms a bridge of land there was a broad strait, which lasted up to the end of the Pliocene, or beginning of the Post-Pliocene period. Volcanoes are frequent in Central America; and basalt and other volcanic products cover a large portion of the country. The large development of trachytes indicates an earlier period of volcanic activity, during which most of the Tertiary strata were metamorphosed into porphyries.

At any rate these rest upon Cretaceous limestones. In many places the clays and sandstones of the Cretaceous age have been metamorphosed into granite rocks. From Pueblo to Durango the Mexican mountains no longer present the appearance of a chain, but spread out to a tableland or elevated plain, from 5,000 to 9,000 feet in height, and from 100 to 300 miles in breadth. Across this plain, close to the 19th parallel, six volcanoes are distributed in a line running east and west, as if a vast rent, extending from the Atlantic to the Pacific, had opened a passage for the internal fires of the globe at this spot. Two of those on the east of the continent, with a group of four or five other cones lying between Jalapa and Cordoba, have an elevation exceeding 17,000 feet, and are the only mountains in New Spain that rise to the region of perpetual snow, which commences here at 15,000 feet above the level of the sea. Jorullo, the lowest of the six volcanoes, rose suddenly in the middle of a plain, in September, 1759, after fearful concussions of the ground, which continued for fifty or sixty days. Near the tropic the Mexican Cordillera divides into three parts. One runs parallel to the eastern coast at the distance of thirty or forty leagues, and terminates in New Leon. Another proceeds in a northwestern direction, and sinks gradually as it approaches the Californian Gulf in Sonora. The third or central Cordillera traverses Durango and New Mexico, divides the sources of the Rio Gila from the Rio Bravo del Norte, and dies out before reaching the Rocky Mountains.

In a scientific survey of the Rocky Mountain range, conducted by Professor Hayden of Yale College, a higher peak was discovered than had been formerly known. Holy Cross mountain was computed to reach 17,000 feet above the sea, or 2,000 feet higher than Big Horn (15,000), which had hitherto been supposed to be the highest of the chain. The greatest altitudes on the North American continent are now said to be the following—Orizaba (18,314) in Mexico, St. Elias (17,900) in Alaska, Popocatepetl (17,884) in Mexico, Holy Cross (17,000), Rocky Mountains, Big Horn (15,000), and Mount Lincoln (14,300), both in the same chain. The Great Salt Lake of Utah is in 41° N. and 112° W., and has intensely salt waters. It is nearly 300 miles in circumference, and its shores, for a breadth of several miles, are covered with an incrustation of very pure salt. It lies in a basin, which measures about 500 miles each way, and contains much fertile soil.

If we run a line westward across the continent of North America at the latitude of Delaware Bay (38°), the geological formations present themselves in the following order: 1. Tertiary and Cretaceous strata on the shores of the Atlantic; 2. Gneiss underlying these strata, and presenting itself on the eastern slope of the Alleghany or Appalachian mountains, but covered in parts by New Red Sandstone; 3. Palæozoic rocks, consisting of Silurian, Devonian, and Carboniferous strata, curiously bent into parallel foldings, with synclinal and anticlinal axes, the crests of the latter forming the ridges of the Alleghany Mountains, which in this region rise to the height of 2,500 feet. Upon these Palæozoic rocks rest three great coal fields—the Appalachian, that of Illinois and that of Michigan, covering a large portion of the space between the Alleghanies and the Mississippi, and embracing collectively an area equal to the surface of Great Britain. From the Mississippi westward to Utah the Palæozoic rocks occur in great folds, between which are extensive areas of Triassic, Oolitic, Cretaceous, and Tertiary beds. In California the rocks are

chiefly metamorphosed secondary strata on which lie patches of Tertiary sediments. In British America there is an enormous development of the Laurentian and Huronian rocks, which are the oldest yet discovered, and occupy most of the country immediately north of the large lakes. Newfoundland and the neighboring British territories consist of Pre-Silurian, Silurian, Devonian, Carboniferous (which includes coal fields of considerable extent), and Triassic rocks. The area north of about 40° N. is also covered and strewn with glacial drift and boulders.

The Ozark Mountains resemble the Alleghanies in their mineral structure, containing the same rocks from the granite to the Carboniferous, and probably upwards to the chalk.

Great River Systems.—In no single circumstance is the superiority of America over the Old World so conspicuous, as in the number and magnitude of its navigable rivers. The Amazon alone discharges a greater quantity of water than the eight principal rivers of Asia, the Yenesei, Indus, Ganges, Ob, Lena, Amoor, and the Hoang-ho and Yang-tse of China. The Mississippi, with its branches, affords a greater amount of inland navigation than all the streams, great and small, which irrigate Europe; and the Plata, in this respect, may probably claim a superiority over the collective water of Africa. But the American rivers not only surpass those of the Old World in length and volume of water,—they are so placed as to penetrate everywhere to the heart of the continent. By the Amazon, a person living at the eastern foot of the Andes, 2,000 miles of direct distance from the Atlantic, may convey himself or his property to the shores of that sea in forty-five days, almost without effort, by confiding his bark to the gliding current. If he wish to return, he has but to spread his sails to the eastern breeze, which blows perennially against the stream. The navigation is not interrupted by a single cataract or rapid, from the Atlantic to Jaen, in west longitude 78° where the surface of the stream is only 1,240 feet above the level of its estuary at Para. The part of North America most remote from the sea is the great interior plain extending from the Rocky Mountains to the Alleghanies and the lakes, between the parallels of 40° and 50°; but the Mississippi, Missouri, and St. Lawrence, with their branches, are wonderfully ramified over this region, and the Missouri is in some degree navigable to the center of the continent. It is only necessary to cast the eye over a map of South America, to see that all the most sequestered parts of the interior are visited by branches of the Plata and the Amazon. These streams, having their courses in general remarkably level, and seldom interrupted by cataracts, may be considered without a figure of speech, as a vast system of natural canals, terminating in two main trunks, which communicate with the ocean at the equator and the 35th degree of south latitude. Since the invention of steam navigation, rivers are, in the truest sense of the term, Nature's highway, especially for infant communities, where the people are too poor and live too widely dispersed to bear the expense of constructing roads. There is little risk in predicting, that in two or three centuries the Mississippi, the Amazon and the Plata, will be the scenes of an active inland commerce, far surpassing in magnitude anything at present known on the surface of the globe. The Mississippi is navigable for boats from the sea to the falls of its principal branch, the Missouri, 1,700 miles from the Mexican gulf in a direct line, or 3,900 by the stream; and the whole amount of boat navigation afforded by the sys-

tem of rivers, of which the Mississippi is the main trunk, has been estimated as equal to 40,000 miles in length, spread over a surface of 1,350,000 square miles. This, however, is perhaps an exaggeration; a navigable length of 35,000 miles may be nearer the truth.

The Amazon contains many islands, is broad, and in the upper part so deep that on one occasion Condamine found no bottom with a line 620 feet long. At its mouth, two days before and after the full moon, the phenomenon called a *Bore* occurs in a very formidable shape. It is a high upright wave of water rushing from the sea, which no small vessel can encounter without certain destruction.

The estuaries of all these great American rivers open to the eastward; and thus Providence seems to have plainly indicated that the most intimate commercial relations of the inhabitants of America should be with the western shores of the Old World. It should at the same time be observed, that this position of the great rivers of America is but one example of a physical arrangement which is common to the whole globe; for it is remarkable that, in the Old World as well as in the New, no river of the first class flows to the westward. Some, as the Nile, the Lena, and the Ob, flow to the north; others, as the Indus and the rivers of Ava to the south; but the largest, as the Volga, the Ganges, the Yang-tse, the Hoang-ho, the Euphrates, and the Amoor, have their courses to the east or southeast. This arrangement is not accidental, but depends most probably on the inclination of the primary rocks, which, in all cases where their *direction* approaches to the south and north, seem to have their steepest sides to the west and the longest declivities to the east. We have examples in the Scandinavian Alps, the mountains of Britain, the Ghauts of India, the Andes, and the Rocky Mountains.

The following table exhibits the lengths, size of the basins, and probable extent of the navigable waters of the greater rivers of America:

Table of Principal American Rivers.

Rivers.	Length, miles.	Area of basin, sq. miles.	Navigable waters, miles.
Mississippi to source of Missouri.....	4,000	1,350,000	35,000
St. Lawrence through the lakes.....	2,200	600,000	4,000
Orinoco.....	1,800	400,000	8,000
Amazon, not including Araguay.....	4,000	2,100,000	50,000
Plata, including Uruguay.....	2,400	1,200,000	20,000

Climates.—The latitude and elevation of the land in each country, its position in reference to the sea, and the direction of the prevailing winds, are the chief circumstances which determine the nature of the climate. We have already mentioned that three-fourths of South America lie within the tropics, and the remaining fourth in the temperate zone; but, in both divisions, it might be naturally inferred that a huge wall like the Andes, rising into the atmosphere to the height of two or three miles, and running across the course of the tropical and extratropical winds, would exert a powerful influence on the temperature, the humidity, and the distribution of the seasons. This is actually the case; and it is this vast chain of mountains, with its prolongation in North America, which affords a key to the most remarkable peculiarities in the climate of the whole continent. The subject admits of being explained in a very simple manner.

The trade-winds blowing from the east occupy a zone 60 degrees in breadth, extending from 30° of N. to 30° of S. latitude. Beyond these limits are variable winds; but the prevailing direction in the open sea, where no accidental causes operate, is well known by navigators to be from the west. Now these winds are the agents which transport the equable temperature of the ocean, and the moisture exhaled from its surface, to the interior of the great continents, where it is precipitated in the shape of rain, dew, or snow. Mountains receive the moisture which floats in the atmosphere; they obstruct and lift the aerial currents, and by causing a reduction of temperature, favor precipitation. Rain, accordingly, in all countries falls most abundantly on the elevated land. Let us consider, then, what will be the effect of a mural ridge like the Andes in the situation which it occupies. In the region within the 30th parallel, the moisture swept up by the trade-wind from the Atlantic will be precipitated in part upon the mountains of Brazil, which are but low, and so distributed as to extend far into the interior. The portion which remains will be borne westward, and, losing a little as it proceeds, will be arrested by the Andes, and fall down in showers on their slopes. The aerial current will now be deprived of all the humidity which it can part with, and arrive in a state of complete exsiccation at Peru, where no rain will consequently fall. That even a much lower ridge than the Andes may intercept the whole moisture of the atmosphere, is proved by a well-known phenomenon in India, where the Ghauts, a chain only 3,000 or 4,000 feet high, divide summer from winter, as it is called; that is, they have copious rains on their windward side, while on the other the weather remains clear and dry; and the rains regularly change from the west side to the east, and *vice versa*, with the monsoons. In the region beyond the 30th parallel this effect will be reversed. The Andes will in this case serve as a screen to intercept the moisture brought by the prevailing west winds from the Pacific Ocean; rains will be copious on their slopes, and in Chili on their western declivities, but none will fall on the plains to the eastward, except occasionally, when the winds blow from the Atlantic. The phenomena of the weather correspond in a remarkable manner with this hypothesis. On the shore of the Pacific, from Coquimbo, at the 30th parallel, to Amatapu, at the 5th of south latitude, no rain falls; and the whole of this tract is a sandy desert, except the narrow strips of land skirting the streams that descend from the Andes, where the soil is rendered productive by irrigation. From the 30th parallel southward the scene changes. Rains are frequent; vegetation appears on the surface, and grows more vigorous as we advance southward. "At Concepcion," says Captain Hall, "the eye was delighted with the richest and most luxuriant foliage; at Valparaiso the hills were poorly clad with a stunted brushwood and a poor attempt at grass, the ground looking starved and naked; at Coquimbo the brushwood was gone, with nothing in its place but a vile sort of prickly pear bush, and a thin sprinkling of gray wiry grass; at Huasco (latitude 28½°) there was not a trace of vegetation, and the hills were covered with bare sand." It follows from the principle we have laid down, that in this southern part of the continent the dry tract should be found on the east side of the mountains, and such is the fact. At Mendoza, in latitude 32°, rain scarcely ever falls, and the district along the east foot of the Andes is known to consist chiefly of parched sands, on which a few stunted shrubs grow, and in which many of the streams that descend

from the mountains are absorbed before they reach the sea. The whole country, indeed, south of the Plata, suffers from drought; but on the eastern side this is remedied to some extent by winds from the east or southeast, which bring occasional rains to refresh the soil. From Amatapu northward, on the other hand, the west coast is well watered and fruitful; and this is easily accounted for. The line of the coast here changes its direction, and trends to the northeast as far as the isthmus of Panama, where the mountains sink to a few hundred feet in height, and leave a free passage to the trade-wind, which here often assumes a direction from the northeast, or even the north. The exhalations of the Atlantic are thus brought in abundance to the coast of Quito, which is in consequence well watered; while the neighboring district of Peru suffers from perpetual aridity.

Our principle applies equally to the explanation of some peculiar facts connected with the climate of North America. The western coast of Mexico, as far as St. Blas or Mazatlan, in latitude 23° N., is well watered, because, *first*, the continent here is narrow; *secondly*, the tableland of Mexico, which is much lower than the Andes of Chili, is not so effectual a screen to intercept the moisture; and, *thirdly*, there is reason to believe that a branch of the trade-wind, which crosses the low part of the continent at Panama and Nicaragua, sweeps along the west coast during part of the year, and transports humidity with it. But beyond the point we have mentioned drought prevails. Soona, though visited occasionally by rains, consists of sandy plains without herbage, where the streams lose themselves in the parched soil without reaching the sea; and even Old California, which has the ocean on one side, and a broad gulf on the other, and ought apparently to be excessively humid, is covered with sterile rocks and sandy hills, where the vegetation is scanty, and no timber is seen except brushwood. This dry region extends as far as 33° or 34° N.; but immediately beyond this we have another change of scene. New California is in all respects a contrast to the Old. It is rich, fertile and humid, abounding in luxuriant forests and fine pastures; and the other American possessions to the northward preserve the same character. How can we account for this singular diversity of climate, except upon the principle which has been explained, namely, that in all regions where ranges of mountains intersect the course of the constant or predominant winds, the country on the windward side of the mountains will be moist, and that on the leeward dry; and hence parched deserts will generally be found on the west side of countries within the tropics, and on the east of those beyond them? Our hypothesis applies equally to the country east of the Rocky Mountains. For the space of about 3,000 miles along the foot of this chain the surface consists of dry sands or gravel, sometimes covered with saline incrustations, almost destitute of trees and herbage, and watered by streams flowing from the mountains, which are sometimes entirely absorbed by the arid soil. The central and eastern part of the basin of the Mississippi would in all probability have been equally barren had the configuration of the land been a little different in the south. A tract of country extremely low and level extends along both sides of this river; and a portion of the trade-wind blowing from the Mexican gulf, finding its motion westward obstructed by the high tableland of the Cordillera, is deflected to the right, and ascends the valley of the Mississippi and Ohio. This wind bears with it the humidity of the torrid zone, and fertilizes a wide region that would otherwise be a barren waste.

The views on the subject of climate we have been unfolding will enable us to throw some light on an interesting point—the distribution of forests. We are induced to think, that in all countries having a summer heat exceeding 70° , the presence or absence of natural woods, and their greater or less luxuriance, may be taken as a measure of the amount of humidity, and of the fertility of the soil. Short and heavy rains in a warm country will produce grass, which, having its roots near the surface, springs up in a few days, and withers when the moisture is exhausted; but transitory rains, however heavy, will not nourish trees, because after the surface is saturated with water, the rest runs off, and the moisture lodged in the soil neither sinks deep enough, nor is in sufficient quantity to furnish the giants of the forest with the necessary sustenance. It may be assumed that 20 inches of rain falling moderately, or at intervals, will leave a greater permanent supply in the soil than 40 inches falling, as it sometimes does in the torrid zone, in as many hours. It is only necessary to qualify this conclusion by stating, that something depends on the subsoil. If that is gravel, or a rock full of fissures, the water imbedded will soon drain off; if it is clay or a compact rock, the water will remain in the soil. It must be remembered, also, that both heat and moisture diminish as we ascend in the atmosphere, while evaporation increases; and hence that trees will not grow on very high ground, though its position in reference to the sea and the prevailing winds should be favorable in other respects. In speaking of the *region of forests*, we neither restrict the term to those districts where the natural woods present an unbroken continuity, nor extend it to every place where a few trees grow in open plains. It is not easy to give a definition that will always be appropriate; but in using the expression, we wish to be understood as applying it to ground where the natural woods cover more than one-fourth of the surface.

Great misapprehensions have arisen with regard to the climate of America, from comparisons being drawn between the east side of the new continent and the west side of the old. We have already pointed out the influence of winds blowing from the sea in modifying the state of the atmosphere over the land, both as to heat and humidity. When this circumstance is attended to, and when the east and west sides of the old and the new continents are respectively compared with one another, the difference is found to be small, and easily accounted for. In the torrid zone, and on the seashore, the temperature of both continents is found to be the same, viz., 82° ; but in the interior the difference is rather in favor of America. There is no counterpart in the New World to the burning heats felt in the plains of Arabia and North Africa. Even in the western and warmest part of the parched steppes of Caraccas, the hottest known region in America, the temperature of the air during the day is only 98° in the shade, which rises to 112° in the sandy deserts which surround the Red Sea. At Calabozo, farther east in the llanos, the common temperature of the day is only from 88° to 90° ; and at sunrise the thermometer sinks to 80° . The basin of the Amazon is shaded with lofty woods; and a cool breeze from the east, a minor branch of the trade wind, ascends the channel of the stream, following all its windings, almost to the foot of the Andes. Hence this region, though under the equator, and visited with almost constant rains, is neither excessively hot nor unhealthy. Brazil, and the vast country extending westward from it between the Plata and the Amazon, is an uneven tableland,

blessed with an equable climate. At Rio Janeiro, which stands low, and is exposed to a heat comparatively great, the temperature in summer varies from 68° to 82° Fahr., and the mean is only about 74° . Farther north, and in the interior, the Indians find it necessary to keep fires in their huts; and in the country near the sources of the Paraguay, hoar-frost is seen on the hills during the colder months, and the mean temperature of the year falls below 65° or 67° . On the declivities of the Andes, and on the high plains of Upper Peru, the heats are so moderate that the plants of Italy, France and Germany come to maturity. Lower Peru, though a sandy desert, enjoys a wonderful degree of coolness, owing to the fogs which intercept the solar rays. At Lima, which is 540 feet above the sea, the temperature varies from 53° to 82° , but the mean for the whole year is only 72° . In the plains of La Plata the mean temperature of the year is very nearly the same as at the corresponding north latitudes on the east side of the Atlantic. At Buenos Ayres, for instance, the mean annual heat is $19^{\circ}.7$ of the centigrade thermometer (68° Fahr.), while that of places on the same parallel in the Old World is $19^{\circ}.8$. The range of temperature is probably greater in the basin of the Plata; but as we advance southwards, the diminishing breadth of the continent makes the climate approximate to that of an island, and the extremes of course approach each other. In the Strait of Magalhaen the temperature of the warmest month does not exceed 43° or 46° ; and snow falls almost daily in the middle of winter, though the latitude corresponds with that of England. But the inference drawn from this, that the climate is unmatched for severity, is by no means just, for the winter at Staten Island is milder than in London. In point of fact, the climate of Patagonia is absolutely colder than that of places in the same latitude in Europe; but the difference lies chiefly in the very low temperature of the summer. This peculiarity no doubt results chiefly from the greater coolness of the sea in the southern hemisphere; for beyond the parallel of 48° , the difference of temperature in the North and South Atlantic amounts, according to Humboldt, to 10° or 12° of Fahrenheit's scale. If we push our researches a step farther, and inquire what is the cause of the great warmth of the Northern Sea, we shall be forced to admit that a very satisfactory answer cannot be given. Something may be due to the influence of the Gulf Stream, a minute branch of which is supposed to carry the waters of the torrid zone to the shores of Shetland and Norway; but such an agent seems too trifling to account for the phenomenon. The sum, then, of the peculiar qualities which distinguish the climate of South America may be briefly stated. Near the equator the new continent is perhaps more humid than the old; and within the tropics generally, owing to its vast forests, the absence of sandy deserts, and the elevation of the soil, it is cooler. Beyond the tropics the heat is nearly the same in the south temperate zone of America and the northern one of the old continent, till we ascend to the latitude of Cape Horn, where we have cold summers and a very limited range of the thermometer.

Forests and Indigenous Products.—Northern America, though its vast forests have now been exposed for centuries to the axe of civilized man, is still one of the best wooded regions of the world. Among the principal forest trees are the pine, oak, ash, hickory, red-beech, Canadian poplar, chestnut, black walnut, maple, tulip-tree, and white cedar.

Central America produces extensively mahogany,

pimento, sarsaparilla, vanilla, Peruvian balsam, and many other valuable woods and drugs.

Nearly two-thirds of the surface of South America is still covered with gigantic forests, which must ultimately disappear, like many of those in the north, before the combined efforts and necessities of commerce and agriculture. The most distinctive and valuable forest trees of South America are the greenheart and mora. The cow tree, which yields a juice very like milk in its properties, is also a remarkable product of this region.

Maize is by far the most important farinaceous product of the New World. It was the only grain which the earliest European settlers found cultivated, to some extent, by the natives. For nutrition it is inferior to wheat, but it is much more prolific, and is suited to a greater variety of soils. Tobacco is also indigenous to America, whence its use has extended over the whole world. Among roots, the potato, which the world owes to America, is without a rival. Millet, tapioca, arrow-root, cocoa, copaiva, cinchona, jalap, sassafras, nux-vomica, the cochineal plant, the agave, or American aloe, and the pineapple are also indigenous to the continent.

It is impossible here to do more than touch on the vast subject of the botany and the indigenous vegetable products of the New World. For fuller information, in addition to that contained in articles in the present work that treat of the geographical distribution of plants, the reader is referred to the numerous valuable American works of such authors as Beck, Bigelow, Breckenridge, Brown, Carson (Medical Botany), Darby, Darlington (Agricultural Botany), Asa Gray, Harvey (Algæ), Ravenel, Sprague, Strong, Torrey, etc. An extended description of the forest trees of North America will be found in the great work of Michaux and Nuttall, *The North American Sylva*.

The Aborigines of the Two Americas.—The origin, history, languages, and condition of the American nations present ample materials for speculation; but before touching on these subjects, the question presents itself, What is the total of the indigenous population? Humboldt, in 1823, estimated the number of Indians at 8,610,000. Bollaert estimated the number existing in 1863 as follows:

Mexico.....	4,000,000
Peru.....	1,600,000
Bolivia.....	1,400,000
Central America.....	1,000,000
Paraguay.....	700,000
Ecuador.....	500,000
United States.....	500,000
Other countries.....	1,314,710
Total.....	11,014,710

It is probable that these numbers have been diminished; the latest official returns of the United States territories, in 1900, estimate the Indian population at 270,544.

The indigenous population of America presents man under many aspects, and society in various stages, from the regular but limited civilization of Mexico and Peru, to savage life in its most brutal state of abasement. At one extremity of the country we find the pigmy Esquimaux of four feet and a half in height, and at the other the Patagonian standing above six feet. In complexion the variety is great, and may be said to embrace almost every hue known elsewhere on the face of the earth, except the pitchy black of the Negro. About one-half of all the known languages belong to America; and if we consider every little wandering horde a distinct community, we have a greater number of nations here than in all the rest of the world. Amidst all this diversity philosophers

have thought they were able to discover certain general characters, sufficiently marked to distinguish the American nations from those of the old continent. It is foreign to our purpose to inquire whether the varieties of form, stature, and complexion, in the human species, are modifications produced by external causes operating differently on distinct portions of the progeny of one primitive pair, or whether several races were originally created, and have given birth, by their mixture, to the amazing varieties we witness. We assume the former opinion as true because the probabilities seem to be in its favor; but the phenomena present themselves to us in the same light in whichever way they originated.

Physiologists are not at one in their accounts of the characteristics of the aborigines of the New World, nor are they agreed as to whether they should be considered one race or several. Blumenbach places them all under one class, except the Esquimaux. Bory St. Vincent divides them into four races, or five if we include the Esquimaux, under the following designations: 1. The *Colombian*, which comprehends the tribes formerly inhabiting the Alleghany Mountains, Canada, Florida, the eastern coasts of Mexico and Central America; and the Caribs, who occupied the West India Islands and Guiana. 2. The *American*, embracing the tribes which occupy all the other parts of South America east of the Andes, except Patagonia. 3. The *Patagonian* race, inhabiting the southern extremity of the continent. 4. The *Neptunian*, inhabiting the western coasts of both divisions of the continent, from California to Cape Horn, and which he considers as essentially the same with the race spread over the Malay Peninsula and the Indian Archipelago. With this race are classed the Mexicans and Peruvians. By another writer the species are reduced to two, the *Colombian* and the *American*; the former including all the North American tribes, with the Caribs, the Mexicans and Peruvians, and other inhabitants of the Cordillera; and the latter the Brazilian Indians and Patagonians. Neither of these systems, when tested by facts, is very satisfactory. Dr. Prichard thinks that the mutual resemblance among the American nations has been exaggerated by some writers; yet it is certain that there is more of a common family character in their organization than in that of the indigenous population of Asia or Africa. "The Indians of New Spain," says Humboldt, "bear a general resemblance to those who inhabit Canada, Florida, Peru, and Brazil. We have the same swarthy and copper color, straight and smooth hair, small beard, squat body, long eye, with the corner directed upwards towards the temples, prominent cheek bones, thick lips, and expression of gentleness in the mouth, strongly contrasted with a gloomy and severe look. Over a million and a half of square leagues, from Cape Horn to the River St. Lawrence and Behring's Strait we are struck at the first glance with the general resemblance in the features of the inhabitants. We think we perceive them all to be descended from the same stock, notwithstanding the prodigious diversity of their languages. In the portrait drawn by Volney of the Canadian Indians, we recognize the tribes scattered over the savannas of the Apure and the Carony. The same style of features exists in both Americas."

On the authority of Dr. Morton, the most natural division of the Americans is into two families, the *Toltecan* and the *American*; the former of which bears evidence of centuries of half-civilization, while the latter embraces all the barbarous nations of the New World, with the exception of the Polar tribes, which

are evidently of Mongolian origin. In each of these, however, there are several subordinate groups, which may be distinguished as the *Appalachian*, the *Brazilian*, the *Patagonian*, and the *Fuegian*. The Appalachian branch includes all the nations of North America, except the Mexicans, together with the tribes of South America north of the river Amazon and east of the Andes. In this race the head is rounded, the nose large, salient, and aquiline; the eyes dark brown, with little or no obliquity of position; the mouth large and straight; the teeth nearly vertical; and the whole face triangular. The neck is long, the chest broad but rarely deep, the body and limbs muscular, but seldom disposed to fatness. In character these nations are warlike, cruel, and unforgiving; they turn with aversion from the restraints of civilized life, and have made but little progress in mental culture or the useful arts. The Brazilian branch is spread over a great part of South America, east of the Andes, including the whole of Brazil and Paraguay, between the river Amazon and 35° S. latitude. Their physical characteristics differ but little from those of the Appalachian branch; they possess, perhaps, a larger and more expanded nose, with larger mouths and lips. The eyes are small, more or less oblique, and far asunder; the neck short and thick; the body and limbs stout and full, even to clumsiness. In character, also, they differ little. None of the Americans are less susceptible of cultivation; and what they are taught by compulsion seldom exceeds the humblest elements of knowledge. The Patagonian branch includes the nations to the south of the Plata, as far as the Strait of Magalhaens, including also the mountain tribes of Chili. They are chiefly distinguished by their tall stature, handsome forms, and indomitable courage. The Fuegians, who call themselves *Yacannacunnee*, rove over the sterile wastes of Tierra del Fuego, which is computed to be half the size of Ireland, and yet their whole number has been computed as not exceeding 2,000. The physical aspect of the Fuegians is altogether repulsive. They are of low stature, with large heads, broad faces and small eyes. Their chests are large, their bodies clumsy, with large knees and ill-shaped legs. Their hair is lank, black and coarse, and their complexion a decided brown, like that of the more northern tribes. Their expression of face is vacant, and their mental operations are to the last degree slow and stupid; they are almost destitute of the usual curiosity of savages, caring little for anything that does not minister to their present wants.

The American race is distinguished by the form of the skull, which, except in its greater length, resembles the Mongol type. The cheek-bones are prominent, but not so angular as in the Mongol head; the occiput is rather flat, the cavity for lodging the cerebellum small, the orbits large and deep. The nose is generally aquiline, but in some tribes flat, and the nasal cavities are large. Compared with the head of the Negro, that of the American is broader and the teeth are less prominent; when placed by the side of the Caucasian head, it is seen to be smaller in size, less round and symmetrical, and less developed in the part before the ear. The skull is generally thin and light. There are, however, many deviations from this typical form. The Carib skull and the Araucanian are large; the Peruvian small and singularly flattened behind, so as to present a short line from the forehead to the occiput.

The color of the Americans, though it includes a considerable diversity of shade, is more uniform than that of the inhabitants of Asia or Africa; and, what is more remarkable, its varieties do not bear any visible

relation to the temperature of the climate. A brownish-yellow, or copper color, as it has been called, pervades nearly all the numerous tribes from the Arctic Ocean to Cape Horn, but still with many different degrees of intensity. The eastern nations of Chili have but a slight tinge of the brown color, and the Boruanes are still whiter. On the northwest coast, from latitude 43° to 60° , there are tribes who, though embrowned with soot and mud, were found, when their skins were washed, to have the brilliant white and red which is the characteristic of the Caucasian race. But within the tropics, the Malapoques in Brazil, the Guaranis in Paraguay, the Guaiacas of Guiana, the Scheries of La Plata, have tolerably fair complexions, sometimes united with blue eyes and auburn hair; and, in the hot country watered by the Orinoco, Humboldt found tribes of a dark and others of a light hue, living almost in juxtaposition. It is remarkable, too, that the nations whose color approaches nearest to black are found in the temperate zone, namely, the Charruas of the Banda Oriental, in latitude 33° south, and the Cochimies, Pericus, and Guaycurus, spread over the peninsula of California. These people have skins of a very deep hue, but are not absolutely black; and they have neither the woolly hair of the Negroes nor their social and good-humored disposition. The Charruas, especially, are distinguished by a high degree of that austerity and stern fortitude which are common to the American nations. The Caribs and some Brazilian tribes have the yellowish hue of the Chinese and the same cast of features. Among the nations dwelling on the west side of the Alleghanies, and near the northern lakes, there is also a considerable variety of complexion; but the brown or copper shade is found more or less in them all. It may be said, then, of the American nations, that, with the exception of two or three tribes on the northwest coast, who probably arrived from Asia at a later period than the others, the two extremes of complexion, the white of Northern Europe and the black of Ethiopia, are unknown among them; and that, when compared with the Moors, Abyssinians, and other swarthy nations of the Old World, their color inclines less to the yellow and more to the reddish brown.

Long, black, lank hair is common to all the American tribes, among which no traces of the frizzled locks of the Polynesian or the woolly texture of the African Negro have ever been observed. The beard is very deficient, and the little that nature gives them they assiduously root out. A copper-colored skin has been also assumed by most writers as a characteristic distinction of the Americans, but their real color is in general brown, of the hue most nearly resembling that of cinnamon; and Dr. Morton coincides in opinion with Dr. McCulloch, that no epithet derivable from the color of the skin so correctly designates the Americans as that of the brown race. There are, however, among them occasional and very remarkable deviations, including all the varieties of tint from a decided white to an unequivocally black skin. That climate has a very subordinate influence in producing these different hues must be inferred from the fact that the tribes which wander in the equinoctial regions are not darker than the mountaineers of the temperate zone. The Puelches, and other tribes of the Magellanic regions, beyond 55° S. latitude, are darker than the Abipones, Mocobies, and Tobas, who are many degrees nearer the equator; and the Botocudos are of a clear brown color, sometimes approaching nearly to white, at no great distance from the tropic; while the Guaiacas under the line are characterized by a fair complexion; the Charruas, who are

almost black, live at the 30^{th} degree of S. latitude; and the still blacker Californians are 25° north of the equator. Everywhere, indeed, it is found that the color of the American depends very little on the local situation which he actually occupies; and never, in the same individual, are those parts of the body which are constantly covered of a fairer color than those which are exposed to a hot and moist atmosphere. Children are never white when they are born, as is the case among even the darkest of the Caucasian races; and the Indian caciques, who enjoy a considerable degree of luxury, and keep themselves constantly dressed, have all parts of their body, except the palms of the hands and the soles of the feet, of the same brownish-red or copper color. These differences of complexion are, however, extremely partial, forming mere exceptions to the general tint which characterizes all the Americans, from Cape Horn to Canada. The cause of such anomalies is not easily ascertained; that it is not climate is sufficiently obvious; but whether or not it arises from partial immigrations from other countries remains yet to be decided.

The Americans of indigenous races might also be divided into three great classes distinguished by the pursuits on which they depend for subsistence—namely, hunting, fishing and agriculture. The greater number of them are devoted to hunting; the fishing tribes are not numerous, and are wholly destitute of the spirit of maritime adventure, and even of fondness for the sea. A few tribes were strictly agricultural before the arrival of Europeans, but a much greater number have become so since. Many tribes regularly resort to all these modes of subsistence, according to the seasons; employing the spring in fishing, the summer in agriculture, and the winter in hunting.

The intellectual faculties of this great family appear to be decidedly inferior, when compared with those of the Caucasian or Mongolian race. The Americans are not only averse to the restraints of education, but are for the most part incapable of a continued process of reasoning on abstract subjects. Their minds seize with avidity on simple truths, but reject whatever requires investigation and analysis. Their proximity for more than two centuries to European institutions has made scarcely any perceptible change in their mode of thinking or their manner of life; and as to their own social condition, they are probably in most respects exactly as they were at the earliest period of their national existence. They have made few or no improvements in constructing their houses or their boats; their inventive and imitative faculties appear to be of very humble capacity, nor have they the smallest tastes for the arts and sciences. One of the most remarkable of their intellectual defects is the great difficulty they find in comprehending the relations of numbers; and Mr. Schoolcraft, the United States Indian agent, assured Dr. Morton that this deficiency was one cause of most of the misunderstanding in respect to treaties entered into between the United States government and the native tribes. The natives sell their land for a sum of money, without having any conception of the amount; and it is only when the proceeds come to be divided that each man becomes acquainted with his own interest in the transaction. Then disappointment and murmurs invariably ensue.

Languages of Aborigines.—Every unwritten tongue is subject to continual fluctuations, which will be numerous and rapid in proportion as the tribe using it is exposed to frequent vicissitudes of fortune, and the individuals composing it have little intercourse with one another. When the population of one of these societies increases, it splits into several branches;

and if these have little intercourse, the original language divides by degrees into as many dialects. These smaller societies subdivide in their turn with the same effects; and, in such continual subdivisions, the dialects of the extreme branches deviate farther and farther from one another, and from the parent tongue, till time, aided by migrations and wars, producing mixtures of different hordes, obliterates all distinct traces of a common origin. The cause of these changes becomes more obvious when we reflect on the principles which give stability to a language. These are, 1. The abundant use of writing; 2. The teaching of a language as a branch of education; 3. Frequency of intercourse among all the people speaking it; 4. The existence of an order of men, such as priests or lawyers, who employ it for professional purposes; 5. Stability of condition in the people, or exemption from vicissitudes and revolutions; 6. A large stock of popular poetry, which, if universally diffused, may almost become a substitute for writing. All these conditions were wanting (with some trifling exceptions) in the whole of the wandering tribes of America. The great multiplication of languages, therefore, proves two things—first, that the people are in a low state of savage life; and secondly, that they have been for many ages in this condition; for time is a necessary element in the process of splitting human speech into so many varieties.

Among the seven or eight millions of American aborigines, it is estimated that there are as many languages spoken as among the seven or eight hundred million inhabitants of the Old World. Just as there is a marked physiological resemblance attaching to all the New World tribes, so judged by the evidence of language, the native American is *sui generis*, having no connection, except the most remote, with the rest of the human family. The few corresponding words in the Old and New World languages, which are not of an imitative character, bear the stamp of fortuitous coincidence rather than that of common origin. Vater, in his *Linguarum Totius Orbis Index*, estimated the number of American aboriginal languages at about 500, and Balbi at 423, of which 211 belonged to North, 44 to Central, and 158 to South America. In the absence of certain data, it may be safe to set down the number of native American languages at about 450.

Throughout the whole of these runs a thread of connection. They are all characterized by *polysynthesis*, as Duponceau calls it, or *holophrasm*, to adopt the phraseology of Dr. Lieber. Holophrasm is a process more or less common to every language at a particular stage of its development. We have glimpses of it in most of the Turanian group of languages, and it appears, in a faint degree, in the Basque; but it belongs to a very large proportion of the languages of America, so extremely numerous, and many of which have nothing else in common. This diffusion of a peculiar and common character over materials so dissimilar has been plausibly accounted for by the supposition of a community of origin in the tribes, whether few or many, which peopled the continent. As no person has the full command of all the vocables in his native language, individual terms must be continually dropped out of dialects preserved by oral communication; and new ones will be introduced as new wants and new objects solicit attention. But during the gradual change which thus takes place, the new words will be combined and modified according to the rules which belong to the genius of the spoken dialect with which they are incorporated; and thus it may happen that the grammatical forms of an ancient language may live, while its materials perish. The changes of

structure which present themselves in the history of European languages, it must be remembered, took place in *progressive* communities. Among nations like the American Indians, whose barbarism, we may suppose, remained almost stationary, the forms of speech might be more permanent, though its substance was in a state of slow but constant mutation. But even were this community of origin admitted, it cannot be looked on as entire and absolute among the American nations.

North American Indians.—Though any attempt to reduce the American population under a few general classes, either on physical or ethnographical grounds, would be idle, we may notice one or two of the most remarkable nations or families.

All the northern coast of the continent is tenanted by the Esquimaux, a dwarfish race, rarely exceeding five feet in height. Their territories commence near Mackenzie's River, in 68° north lat., and extend to the Arctic Ocean. They occupy all the northern Archipelago, the shores of Hudson's and Baffin's Bays, of Labrador, and of Russian America round by Behring's Straits, to the peninsula of Alaska. They live entirely by fishing, the whale and the seal being their most common food; they inhabit skin tents during their short summer, and in winter caves or houses built with snow in the shape of domes, within which a single rude lamp is kept perpetually burning. They are crafty and dirty, but appeared to Captain Franklin more intelligent and provident than the northern Indians. There is a wide diversity in their dialects, which still display decided marks of identity in their roots.

The northwest coast of Alaska from Cook's Inlet to the 48th parallel, is inhabited by four tribes, of whom the Kaluschi are the most remarkable. These people are distinguished from all the native races of America by having as fair a complexion when their skins are washed as the inhabitants of Europe; and this distinction, accompanied sometimes with auburn hair, has been considered as indicating an origin different from that of the copper-colored tribes who people all the rest of the continent.

The Indians of the east coast belong almost entirely to three stems; and, before the arrival of the English colonists, occupied both sides of the Alleghany Mountains from the Gulf of Mexico to Canada and New Brunswick. 1. The Delaware or Algonquin Indians, comprehending the Ottogamies, Shawnees, Narragansetts, Chippeways, Knisteneaux, Delawares, and other nations, to the number of thirty or forty, were spread over the space between the Mississippi and the Atlantic, as far north as Hudson's Bay, and all spoke dialects of one language. 2. The Iroquois, often called the "Five Nations," and the "Six Nations," but comprehending 15 tribes or more, among whom were the Mohawks, Oneidas, Hurons and Senecas, all spoke dialects of one language. They lived on the south side of the great lakes, and finally obtained a complete ascendancy over the Algonquin race. 3. The Florida Indians, included the Creeks, Seminoles, Choctaws, Chickasaws, Natches, and Mobiles. Tribes belonging to these three families (with the Wocons and Catawbias) occupied nearly all the region east of the Mississippi, from the Gulf of Mexico to Hudson's Bay, comprising more than a million of square miles. The Catawbias alone, however, are said to have included 20 tribes, and nearly as many dialects. The Powhatans were a confederacy of 33 tribes, comprehending 10,000 persons. It is probable that when the English settlers landed in this country,

the region mentioned was inhabited by a quarter of a million of Indians, divided into many tribes. In regard to these tribes the following (written some years ago) is interesting:

These nations have the virtues of savage life—a high sense of honor, according to their perceptions of duty, mutual fidelity among individuals, a fortitude that mocks at the most cruel torments, and a devotion to their tribe which makes self-immolation in its defence easy. On the other hand, they treat their wives cruelly, and their children with indifference. The apathy under the good and ill of life which the stoic affected, is the grand element of the Indian's character. Gloomy, stern, and severe, he is a stranger to mirth and laughter. All outward expression of pleasure or pain he regards as a weakness; and the only feeling to which he ever yields is the boisterous joy which he manifests in the moment of victory, or under the excitement of intoxication. He is capable of great exertions in war or the chase, but has an unconquerable aversion to regular labor. He is extremely improvident; eats enormously while he has abundance of food, without thinking of the famine which may follow; and, when liquors are supplied to him, will continue drunk for days.

Most of the Indians of North America believe in the existence of a supreme being, whom they call the Great Spirit; and of a subordinate one, whose nature is evil and hostile to man. To the latter their worship is principally addressed; the Good Spirit, in their opinion, needing no prayers to induce him to aid and protect his creatures. They generally believe in a future state, in which the souls of brave warriors and chaste wives enjoy a tranquil and happy existence with their ancestors and friends, spending their time in those exercises in which they delighted when on the earth. The Dakotas believe that the road to these "villages of the dead" leads over a rock with an edge as sharp as a knife, on which only the good are able to keep their footing. The wicked fall off, and descend to the region of the Evil Spirit, where they are hard worked, and often flogged by their relentless master.

Polygamy is allowed; and a number of wives is considered as adding to a man's consequence. Marriage customs differ in different tribes, but in every case the presenting of gifts to the father of the intended wife is an essential feature of the transaction, and shows that the wife is considered as procured by purchase. Deformed children, and lame or decrepit old persons, are destroyed sometimes; but the practice is uncommon. Incest and unnatural vices are practiced in some tribes, but they are always viewed as matters of reproach. The Indian funerals are conducted with much decorum. The deceased is dressed in his best clothes, and laid in a grave, in a vertical, horizontal, or inclined position, according to his own previous directions, with his moccasins, knife, money, and silver ornaments beside him, and a small quantity of food near his head. It is usual to mark the graves with a post, on which figures are carved expressive of the nature of the pursuits and achievements of the deceased.

Some nations of Indians wear little or no clothing, but the general dress of the men in the temperate and cold parts of the country, previous to the arrival of the Europeans, consisted of three articles: a cloak of buffalo-skin hanging from the shoulders, a piece of skin used as an apron, and a pair of moccasins or loose boots, made of undressed skin also. The women wore a long robe of the same material, which was fastened round the waist; but among the tribes living near the whites, coarse woollens are now fre-

quently substituted for the hides of wild animals, except for the moccasins. The habitations of the Indians are huts or cabins, generally of a circular form and small size, but sometimes of 30 or 40 feet in diameter, formed by stakes fixed in the ground, and covered with the bark of trees. Sometimes the spaces between the stakes are filled up with twigs, grass, and mud, and the roof is covered nearly in the same way. A hole in the top serves for the escape of the smoke, and the skins of wild beasts form the beds and seats. When they go to a distance to hunt, they erect for temporary use large tents, which are covered with skins. On the west side of the Mississippi, where the ground is open, many of the tribes make use of horses, which are seldom employed amidst the woods covering the territories east of that river. The custom of painting their bodies is nearly universal. They introduce the colors by making punctures on their skin; and the extent of surface which this ornament covers is proportioned to the exploits they have performed. Some paint only their arms, others both their arms and legs, others again their thighs; while those who have attained the summit of warlike renown have their bodies painted from the waist upwards. This is the heraldry of the Indians, the devices of which are probably more exactly adjusted to the merits of the persons who bear them than those of more civilized countries. Besides these ornaments, the warriors also carry plumes of feathers on their heads, their arms or ankles. Their arms were the tomahawk, the war-club, knife, the bow and arrow, but now they have muskets.

Each tribe is governed by a chief and council, who are elective; but in matters of moment the whole of the warriors are consulted; and Mr. Keating informs us that questions are not decided by the votes of a majority, but the resolution adopted must have the consent of every individual warrior. Their assemblies are conducted with much formality and decorum. The eldest chief commences the debate, which is often carried on by set speeches, abounding in bold figures and metaphors, and bursts of a rude but impassioned eloquence. The young are permitted to be present and express their approbation by cries, but not to speak. In their wars the object commonly is, to secure the right of hunting within particular limits, to maintain the liberty of passing through their accustomed tracts, and to guard from infringement those lands which they consider as their own tenure. War is declared by sending a slave with a hatchet, the handle of which is painted red, to the nation they intend to break with. They generally take the field in small numbers. Each warrior, besides his weapons, carries a mat, and supports himself till he is near the enemy by killing game. From the time they enter the enemy's country, no game is killed, no fires lighted, or shouting heard, and their vigilance and caution are extreme. They are not even permitted to speak, but must communicate by signs and motions. Having discovered the objects of their hostility, they first reconnoitre them, then hold a council; and they generally make their attack just before daybreak, that they may surprise their enemies while asleep. They will lie the whole night flat on their faces without stirring, and, at the fit moment for action, will creep on their hands and feet till they have got within a bow-shot of those they have doomed to destruction. On a signal given by the chief warrior, which is answered by the yells of the whole party, they start up, and, after discharging their arrows, they rush upon their adversaries, without giving them time to recover from their confusion, with their war-clubs and tomahawks. If they

succeed, the scene of horror which follows baffles description. The savage fury of the conquerors, the desperation of the conquered, the horrid yells of both, and their grim figures besmeared with paint and blood, form an assemblage of objects worthy of pandemonium. When the victory is secured, they select a certain number of their prisoners to carry home; they kill the rest in cold blood, take their scalps, and then march off with the spoils. The prisoners destined to death are soon led to the place of execution, where they are stripped, have their bodies blackened, and are bound to a stake. In this situation, while the burning faggots embrace his limbs, and the knives of his revengeful enemies are inflicting a thousand tortures, it is common for the warrior to recount his exploits, boast of the cruelties he has committed upon his enemies, and to irritate and insult his tormentors in every way. Sometimes it happens that this has the effect of provoking one of the spectators to dispatch him with a club or tomahawk. Sometimes the male adult prisoners are given as slaves to women who have lost their husbands in the war, and by whom they are often married. The women taken are distributed among the warriors; the boys and girls are considered as slaves.

Nearly all the Indian tribes raise maize, beans, and pumpkins, by the labor of their women, but only to a small extent, and as a resource against famine, their chief reliance being upon the chase. The buffaloes formerly wandering over the prairies of the West, in herds of tens of thousands, were their great support; but deer, bears, and, in time of need, otters, beavers, foxes, squirrels, and even reptiles were devoured.

The exterior circumstances of the Indian have been somewhat changed of late years by his deposition in agencies, under the control of the government, and the efforts to civilize these people are meeting with partial success.

PRE-HISTORIC PEOPLES OF THE AMERICAS AND THEIR DESCENDANTS.

The origin of the populations of America is a problem which has yet to be solved. It is known that in Europe man was in existence at a very remote period; and there are facts which lend some support to the view that man had also been a denizen of America for ages. Thus there have been found portions of the human skeleton and fragments of human handiwork, associated with the bones of mammals which now have no existence, under circumstances which imply great antiquity. In most instances, however, it is not certain that such relics are of the age of the deposit in which they have been found. Human skeletons and bones in a fossilized state, or associated with bones of extinct mammals, have been found at Guadaloupe, in Missouri, near Natches, at New Orleans, in the coral reef of Florida, near Charleston, in California, in Orchilla, at Petit Anse, and in Kansas. Some of these are referred to a very distant period. Thus the conglomerate in which the remains occur in the Florida reef is estimated by Agassiz to be 10,000 years old; but what is still more amazing, the skeleton found by Dr. Dowler beneath four buried forests in the delta near New Orleans, is said to be 50,000 years old, and the remains from California were found in a deposit beneath Table Mountain, which deposit was formed in an old river of the Post-Pliocene, or Pliocene period. At any rate, when this deposit was formed there was a river valley here, down which an overflow of volcanic matter was poured. Since that time denudation has been so great, and the volcanic

matter so hard, that the sides of the valley have been swept away, leaving the valley bottom with its protecting cover standing up far above the level of the neighboring country. Articles made by man also occur under conditions indicating great antiquity. Thus along the coast of Ecuador there are volcanic deposits which belong to the period of volcanic activity preceding the present, which may probably be referred to the Post-Pliocene period. This matter is arranged in terraces, and in one of these terraces, now 24 miles from the coast and 150 feet above the level of the sea, Mr. Wilson has found beneath the vegetable mold, beds of clay with sand and gravel which contain fragments of pottery. These beds, it is believed, were deposited beneath the sea, implying an elevation of 150 feet since their formation. On the coast there is a pottery-containing stratum, which has been followed for 80 miles, and patches of a similar bed occur a farther distance of 200 miles. These facts taken in conjunction with what we learn from the traditions and histories of numerous nations, as also the characters of the present natives, render it highly probable that man existed in America long before the origin or the arrival of the civilized communities to which allusion will be presently made. The histories of these communities generally agree that civilization was introduced by persons who first appeared as strangers amidst the people already in possession of the country. Hence the question has a two-fold aspect, viz., the origin of the first civilizer, as well as that of the earliest civilized tribes. It is possible, as the traditions suggest, that people have arrived from various quarters and at various times. As yet we have little positive evidence to rely upon, and caution is required in drawing conclusions from resemblances in customs or religion. For instance, to take one remarkable case: Amongst tribes living high up the Amazon basin there are customs which correspond with those in Borneo. In both areas we find blow-pipes for discharging arrows; large houses inhabited by several families and similarly constructed; baskets and bamboo boxes of almost identical form and construction; and the smoke-dried head of enemies hung up in the houses. In one tribe on the Amazon the throwing-stick is used, and not the blow-pipe, which is employed by all the surrounding tribes; the throwing-stick is also used by the Esquimaux, the Andaman Islanders, and the Australians. On the Amazon an arrow or spear is used for catching turtle, which has the barb loosely attached to the shaft, so that when the turtle disappears the shaft floats on the surface and indicates its movements and position. The Australians catch turtle in precisely the same way. Again, many other customs are common to the Americans and tribes living in areas far remote from them, with which they have no apparent relationship. If these analogies were always proof of affinities, then we might infer, as has been done, that America was first peopled by emigrants from the opposite shores of Africa, W. Europe, E. Asia, and Polynesia.

In the great valley of the Mississippi and its mighty tributaries, the Ohio and Missouri, are the remains of the works of an extinct race of men, who seem to have made advances in civilization far beyond the races of *red men* discovered there by the first European adventurers. These remains consist chiefly of tumuli and ramparts of earth, enclosing areas of great extent and much regularity of form. Some of them recall the barrows of Europe and of Asia, or the huge mounds and ramparts of Mesopotamia, as displayed at Babylon and Nineveh; while others remind us of the ruined hippodromes and amphitheatres of the Greeks and

Romans. In what part of North America the barrows are usually truncated cones; but in advancing farther south, they often assume the figure of four-sided pyramids in successive stages, with flattened tops, like the *Teocallis*, or temples of Mexico and Yucatan. They have been accurately described, and many of them delineated, in the *Smithsonian Contributions to Knowledge*, from the researches of Messrs. Squier and Davis. (See MOUNDBUILDERS.)

The barrows and ramparts are constructed of mingled earth and stones; and from their solidity and extent, must have required the labor of a numerous population, with leisure and skill sufficient to undertake combined and vast operations. The barrows often contain human bones, and the smaller tumuli appear to have been tombs; but the larger, especially the quadrangular mounds, would seem to have served as temples to the earlier inhabitants. These barrows vary in size, from a few feet in circumference and elevation, to structures with a basal circumference of 1,000 or 2,000 feet, and an altitude of from 60 to 90 feet, resembling, in dimensions, the vast tumulus of Alyattes near Sardis. One in Mississippi is said to cover a base of six acres. The ramparts also vary in thickness, and in height from 6 to 30 feet, and usually enclose areas varying from 100 to 200 acres. Some contain 400; and one on the Missouri has an area of 600 acres. The enclosures generally are very exact circles or squares, sometimes a union of both; occasionally they form parallelograms, or follow the sinuosities of a hill; and in one district, that of Wisconsin, they assume the fanciful shape of men, quadrupeds, birds, or serpents, delineated with some ingenuity, on the surface of undulating plains or wide savannas.

These ramparts are usually placed on elevations or hills, or on the banks of streams, so as to show that they were erected for defensive purposes, and their sites are judiciously chosen for this end. The area enclosed, therefore, bears no proportion to the relative labor bestowed on such ramparts: thus, in Ohio, an area of not more than 40 acres is enclosed by mounds of a mile and a half in circumference; and on the Little Miami, in the same State, is found an enclosure fully four miles round, that contains an area of about 100 acres. These remains are not solitary and few, for in the State of Ohio they amount to at least 10,000.

The enclosures in the form of animals are more rare than those now noticed, and seem nearly confined to Wisconsin. One of these represents a gigantic man with two heads, the size of which may be estimated, by the body being 50 feet long, and 25 feet across the breast. Another on a slope near Bush Creek, represents a tolerably designed snake, with an oval ball in its mouth; the undulating folds of its body and spiral of its tail extending to a length of 700 feet. The forms of quadrupeds and birds are also characteristically represented in these works. Those that have been explored contain human bones; but, though the Indians deposit their dead with them occasionally, they have no tradition of their having belonged to their ancestors. The most probable supposition respecting them is that of Mr. R. C. Taylor, that each was the sepulchral monument of a different tribe, who have all disappeared from America.

The question immediately suggests itself, to what people must we ascribe those vast works? They can scarcely be the works of the ancestors of the red men discovered by Europeans in North America. Neither can we ascribe them to the early Greenland and Iceland colonists, who seem never to have passed westward of the Alleghanies. We can scarcely attribute

them to the somewhat apocryphal advent of Welsh Madoc. Can their authors be the people obscurely mentioned in the Icelandic *sagas*, as the inhabitants of *New Iceland*?

A curious tradition of the present Iroquois records that when the *Lenni Lenapi*, the common ancestors of the Iroquois and other tribes, whose language is still widely spread among the Indians, advanced from the northwest to the Mississippi, they found on its eastern side a great nation more civilized than themselves, who lived in fortified towns and cultivated the ground. This people at first granted the Lenni Lenapi leave to pass through their territories to seek an eastward settlement, but treacherously attacked them while crossing the river. This conduct gave rise to inveterate hostilities, that terminated in the extermination or subjugation of their opponents, and the establishment of the red men in those regions. This not improbable, though imperfect, account of such rude communities, where neither letters nor hieroglyphics existed, is probably all that we shall ever learn of the people who executed those works that now excite our surprise.

As we advance southward we find proofs of still greater refinement on the tableland of Anahuac or Mexico; and on descending into the humid valleys of Central America, the peninsula of Yucatan, and the shores of Honduras, we find striking remains of the semi-civilization of the races that inhabited those countries before the Spanish invasion. The barbarous policy of Cortez and other invaders was to eradicate every trace of the former grandeur of the native races, and thereby to inure them to a degrading servitude. The systematic destruction of the native works of art and gorgeous buildings in Mexico was relentlessly carried on for ages, to the infinite regret of the modern ethnographical inquirer. Little positive information on these subjects can be gleaned from the early Spanish historians of the conquest; and it was not until the publication of Humboldt's *Researches* that Europe knew anything of the state of the Great Mexican pyramid, or of the wonderful remains of Palenque and Papantla.

In the middle of the last century, however, some Spanish adventurers penetrated with difficulty the dense forests of the Mexican province of Chiapas, in which they discovered the remains of an ancient city, of which all memory had been lost, and to which they gave the name of PALENQUE, from a poor adjacent village. Stimulated by their report, the Spanish Government some years afterwards despatched two intelligent travellers to explore those wilds; but the report of Del Rio and Du Paix, from the commotions that agitated Europe and convulsed Spain, remained unpublished until a few years ago. It has since appeared, with very interesting designs of the ruins they explored. Our knowledge of such remains, however, has been greatly enlarged by the labors of an enterprising citizen of our own country, Mr. Stephens, given to the world in four volumes, entitled *Incidents of Travel in Central America, Chiapas, and Yucatan*, 1838, and *Incidents of Travel in Yucatan*, 1842. This gentleman discovered, in the almost impenetrable forests of those regions, the remains of no less than 44 towns, some of them with extensive and highly decorated structures. These exhibit walls of hewn stone, admirably put together with mortar, often enriched by sculptures in bold relief, and hieroglyphical inscriptions, exactly resembling the Aztec MSS in our various museums, and in the publications of Humboldt; well executed vaulted roofs, and obelisks covered with mythical figures and pictorial or hiero-

glyphic inscriptions. These curious remains have been concealed for ages by a luxuriant tropical vegetation, so dense that they seem to have been unknown to people living within half a mile of their site.

The most conspicuous ruins are those of temples and palaces, which almost invariably have a pyramidal form, in several stages, with wide intervening terraces, the ascent to which is by grand flights of steps. The chambers in those buildings have generally a length disproportioned to their width; they have no windows, but receive their light from the doors, just as the rooms do at this day in Barbary and some other eastern countries. The apartments are in two parallel rows; a narrow corridor or series of chambers runs along the front and the apartments behind this receive their light only from the front rooms into which they open. Yet these interior apartments are often richly decorated with sculptures, ornamented with stuccos, and gaily painted red, yellow, white, and black.

The ruins of Palenque, as may be seen in the researches of Humboldt, have the characters just mentioned. They are covered with hieroglyphics, and sculptures in relief, with ornamental cornices. The largest building stands on a terrace, faced with stone, measuring 310 by 260 feet; the building itself is 200 by 180 feet; its walls are 25 feet high. The stone has been originally covered with painted stucco, fronts the east, and contains 14 doors, separated by piers ornamented with stucco figures. In this building some of the figures are erect, while others sit cross-legged, in what we term the oriental fashion; one statue, 10½ feet high, was found at Palenque; and two fragments of two *torsoes* and a head were also discovered that exhibited a severe but fair style of sculpture, that recalls imperatively something of the early style of Greek art.

The ruins at Copan, in Honduras, are of vast extent. Here a pyramidal structure remains, with an elevation of 150 feet measured along its slope, and this appears to be a principal temple, included with several smaller structures within a *sacred enclosure*, in the manner of the temples of ancient Egypt. On its walls are many skulls of a quadrumanous animal, well executed in high relief; a large figure of a baboon was discovered among the ruins, bearing no inconsiderable resemblance to the cynocephalus of the Egyptians. Here also several sculptured obelisks occur, from 11 to 13 feet in height, and from 3 to 4 feet wide, which, as well as the walls of the temple, were highly ornamented with sculptures in bold relief.

The similarity between the ruins at Copan and Palenque, and the identity of the hieroglyphic tablets in both, show that the former inhabitants of Chiapas and Honduras had the same *written* language, though the present Indians of those provinces do not understand each other.

At several places, but more especially at Uxmal, in Yucatan, are very magnificent ruins of the same kind. Here are found sculptured obelisks, bearing on their principal face the figure, probably, of some deity, with a benignant countenance represented in full, and the hands applied to the breast. The other sides of the obelisks are covered with hieroglyphical tablets, proving that the same race once inhabited the plains of Honduras and the table-land of Anahuac. The principal building at Uxmal seems to have been a very magnificent pyramid in three stages or terraces, faced with hewn stone, and neatly rounded at the angles. The first terrace is 575 feet long, 15 feet broad, and 3 feet high, serving as a sort of plinth to the whole; the second terrace is 545 feet long, 250 feet

wide, and 20 feet high; the third terrace is 360 feet long by 30 feet wide, and 19 feet in height. From the center of the second terrace, the upper part is gained by a vast flight of well-constructed steps 130 feet wide. This leads to the temple, the façade of which is no less than 322 feet long, but has not had a greater elevation than 25 feet; yet its grandeur is enhanced by the rich sculpture that covers the upper part above a fillet, or cornice, that surrounds the whole building at about half its elevation. The interior consists of two parallel ranges of chambers, 11 in each row. The front apartments are entered by 11 doorways, enriched with sculpture, which gives sufficient light to those rooms; but the posterior row receives no light except what enters by their doors from the exterior rooms. The roofs here, unlike those of Palenque and Copan, are not stone arches, but are supported on bearers of a very hard wood, that must have been brought from a distance of some hundred miles, and these beams too are covered with hieroglyphics. The flat roof of this building has been externally covered with a hard cement. In a building placed on a lower level is a rectangular court, which has been once wholly paved with well-carved figures of tortoises in demi-relief. These are arranged in groups of four, with their heads placed together; and from the dimensions of the court, this *sala de las Tortugas* must have required 43,660 of such carved stones for its pavement.

The ruins of Chichen, also in Yucatan, extend over an area of two miles in circumference. One of the best preserved buildings with an ambit of 638 feet, is constructed in three terraces, which gave it an apparent altitude of 65 feet. The buildings here, on the second terrace, have the façades highly sculptured, both above and below the horizontal fillet; and the doorways are enriched with mouldings, and *truss*-like ornaments supporting a drip-stone. The staircase here is 56 feet wide. The front apartments are 47 feet long and only 9 wide. There are three doors in the front, and in the central apartment are nine niches. The roofs are stone arches; and all have been once painted of various colors. A curious adjoining structure consists of two parallel stone walls, 274 feet long, and 30 feet apart. The walls are 30 feet thick. It has been conjectured to have been connected with the celebration of some public games, like the *palastræ* of the Greeks.

In several of the ruins now noticed are found buildings to which there is no access. They have doorways, but these seemed to have been walled up when the buildings were erected. Their use is unknown; they are named *casas cerradas*, or "shut-up houses." Their interior does not differ from the other apartments above described.

It is worthy of notice, that the builders of those cities took great pains to supply them with one of the prime essentials of human comfort—abundance of good water, by means of wells and cisterns of excellent construction.

The remains in all the 44 ancient towns visited by Stephens have a similar character; so that we can have no hesitation to ascribe them to the same nation, or to kindred races of men, who had most certainly attained no inconsiderable civilization, although unacquainted with the use of iron, or even of bronze. Many of these towns are repeatedly referred to in the native histories, and it is almost certain that a large proportion of them were founded and inhabited by the Tutul-Xius, Nahoas, and other tribes speaking the Nahuatl tongue. In not a few instances the dates and the names of the founders have been preserved.

It has been generally admitted by physiologists that the temperate regions of the globe are best fitted to develop all the powers of our nature; and it is a fact in accordance with this opinion, that among the aborigines of America civilization followed very closely the chain of the Andes, and was found either upon their sides or the table-land of their summits, where the elevation of the ground moderates the heat of the tropical sun, and produces a climate analogous to that of Central and Southern Europe. This civilization did not exist merely at the two distant and isolated points of Mexico and Peru, but presented itself at intermediate places, and may be said to have formed a continuous line from lat. 35° N. to lat. 35° S., with few interruptions, except at those parts where the mountainous chain disappears, or sinks down to a trifling elevation. Some large buildings near the Rio Gila, in lat. 33° N., with fragments of porcelain, indicate the existence of a people there who had some knowledge of the arts. These were most probably a branch of the Aztecs or Toltecs, who afterwards occupied Mexico, as the annals of that country tell. Though some pursued their march southward, it may be reasonably supposed that a part remained in the district; and the Indians living here, who cultivate corn, weave cloth, and live in villages consisting of houses built of solid materials, sometimes two stories in height, may either be their descendants, or have borrowed from them the improvements they possess. Next in order as we proceed southward, are the various nations of Mexico, of whose condition we shall speak by and by. In Chiapa were the Zapotecs, in Yucatan the Mays, in Guatemala the Quiches and Kachiquels, all nearly as much advanced in civilization as the Mexicans, and probably of the same primitive stock. From this point, where the Andes lose their elevation, or break into isolated cones, no distinct traces of civilization appear till we enter the southern continent. Here were found the Muyscas or Moscas, on the table-land of Bogota, a nation consisting of several tribes, who worshipped the sun and practiced some of the useful arts. To these succeeded the nations of Peru, living under the Incas, whose dominion extended from the equator to the 35th degree of S. latitude. Beyond this boundary were the Chilian tribes, who, though inferior to the Peruvians, had made some advances beyond the rudeness of the savage state. It is proper to mention that some of the nations named were extinct before the arrival of the Spaniards; but the degree of civilization they had attained is attested by the monuments they have left behind them. There were no other tribes in the new continent which had made any progress in social improvements. We would not except the Guaranis of Brazil, and a few others, who derived their subsistence chiefly from agriculture, but were in other respects savages. We place among the exceptions, however, the extinct race of the Alleghewis, or whatever was the name of the people, who erected the military works existing between the Ohio and the northern lakes; but they also, it must be remembered, inhabited a temperate climate, though not a mountainous country. It may be affirmed, then, as a general proposition, that from 35° of N. to 35° of S. latitude, the sides and summits of the Andes were the exclusive seats of American civilization. We admit that some of the tribes in Chiapa, Oaxaca, and Yucatan, inhabited low districts; but they were still near the Cordillera, and may be fairly considered as offshoots from the nations dwelling upon it. The fact is important as marking the effects of climate on the active energies of our species. There is no doubt that, with

the improved arts of modern times, civilization can subsist under the burning sky of the torrid zone, but not in such vigor as in countries which enjoy a more moderate temperature. Perhaps it will be found that the moral and physical powers of man attain their highest perfection in those regions where he is accompanied by *wheat* and the *vine*. The zone occupied by the former extends from the 30th to the 57th or 58th parallel; and within the tropics the corresponding climate is found on the flanks or summits of mountains, from 4,500 to 10,000 feet above the level of the sea.

It is remarkable that the Mexican annals reach to a very remote date, although they were preserved merely by picture-writing. We do not pretend to enter into the question as to the authenticity of the records themselves, and their correctness. It is enough that they have received credit from Humboldt, Vater, and other men of learning and judgment. From the annals thus preserved, of which further details will be subsequently given, we learn that at the earliest dawn of history the Quinames were in possession of the country, that civilization was introduced by strangers coming from the east, and that several nations belonging to one race migrated in succession from the northwest, and settled in *Anahuac*, or Mexico. The Toltecs, it is stated, left their original seat, far to the west, in 544 of our era, and after a long journey invaded Mexico, then occupied by wandering hordes, in 648. This people, who penetrated to Nicaragua, if not to South America, were nearly destroyed after the lapse of some centuries; but were followed by the Chichimecs, a half savage tribe, about 1120, and these, a few years afterwards, by the Anahuatlcls, or seven tribes, including the Acolhuans, the Tlascaltecs, and the Aztecs, or proper Mexicans. All these people spoke dialects of one language, and had similar arts, customs, and institutions. The town of Mexico, or Tenochtitlan, was founded in 1325, and the series of Mexican kings which commenced in 1352 was continued through eight monarchs to Montezuma. The monarchy was small at first, and passed through many vicissitudes; but it was gradually enlarged, especially by the policy and enterprise of the later princes of the line. When Cortes arrived, it embraced what are now the provinces of Vera Cruz, Oaxaca, Puebla, Mexico, and part of Valladolid, a surface of 130,000 square miles; but within this were comprehended three small independent states, Tlascal, Cholullan, and Zapeaca. The pastoral state, which forms the intermediate stage between savage and civilized life, had never existed in Mexico; for the native wild ox had not been tamed, and the use of milk as food was unknown. The Mexican nations derived their subsistence from agriculture, which, however, was conducted in the rudest manner, with very imperfect instruments. They cultivated maize, potatoes, plantains and various other esculent vegetables. They raised cotton, and understood the art of spinning and weaving it into cloth, of a texture which excited the admiration of the Spaniards. They had no iron, but showed considerable skill in fashioning the gold, silver, and copper found in a native state, into domestic utensils and ornamental articles. In some of their buildings the stones were hewn into regular forms, and accurately joined; and from the ruins of the palace of Mitla, in Oaxaca, still existing, it appears that they had the art of designing ornaments like arabesques, in paste, with great neatness, and attaching them to the walls; but solid structures of masonry evincing any considerable skill are extremely rare in the country. Their carvings in

wood were tolerably well executed, but the figures were disproportioned and uncouth. The same remark applies to their hieroglyphical drawings, which were far inferior in taste and design to those of the Hindoos, Japanese and Thibetians. For paper they employed sometimes the large leaves of the aloe, sometimes cotton cloth, or the skins of deer dressed. Their books consisted of strips or webs of such material, composed of pieces neatly joined, one or two feet broad and twenty or thirty long, which were divided into pages by folding them in a zig-zag manner; and two pieces of thin deal attached to the outermost folds served as boards, and gave these manuscripts, when closed, an appearance very much like our old folios in wooden binding. The written language of Mexico contained a few real hieroglyphics or symbols, purely conventional, to designate such objects as water, earth, air, day, night, speech, and also for numbers; but it was essentially a system of *picture-writing* in which objects were represented by colored figures having a resemblance more or less exact to themselves. With all its necessary imperfections, this instrument was familiarly employed to a prodigious extent in deeds and instruments for effecting the transmission and sale of property. The government kept couriers for conveying intelligence from all parts of the empire; and the capital was watched and cleaned by a sort of police establishment. This is the bright side of Mexican civilization. On the other hand, it must be kept in view that the Mexicans had no tame animals, no made roads, no money to serve as a universal medium of exchange in commercial transactions. The government was originally a perfect feudal monarchy, in which all power was monopolized by a numerous nobility and the priesthood. The great mass of the people were serfs, attached to the soil, and transferred with it from owner to owner by descent or purchase. The peasants or slaves of a nobleman were allowed a certain portion of land, which they cultivated in common for their subsistence; the rest of their labor belonged to their lord. The country swarmed with beggars, and thousands were swept off every few years by famine. As among the ancient Egyptians and the Chinese, immutable custom, regulating every act of civil and common life, chained up the course of improvement, and spread a languid monotony over society. The crown was elective, and the powers of the monarch small, till the privileges of the nobles were destroyed by the policy and ambition of Montezuma. The religion of the Mexicans breathed a savage spirit, which degraded them, in a moral point of view, far below the hordes of wandering Indians. Their deities, represented by mis-shapen images of serpents and other hideous animals, were the creation of the darkest passions of the human breast, of terror, hatred, cruelty, and revenge. They delighted in blood, and thousands of human sacrifices were annually offered at their shrines. The places of worship, called Teocallis, were pyramids composed of terraces placed one above another, like the temple of Belus at Babylon. These were built of clay, or of alternate layers of clay and unburnt bricks, but in some cases faced with slabs of polished stone, on which figures of animals are sculptured in relief. One or two small chapels stood upon the summit, enclosing images of the deity. The largest known, which is composed of four stories or terraces, has a breadth of 480 yards at the base, and a height of 55. These structures served as temples, tombs, and observatories; and it is remarkable that their sides are always placed exactly in the direction of the meridian. This leads us to the most interesting fact connected with Mexican civilization, we mean the

perfection of their calendar. The civil year was composed of 365 days, divided into 18 months of 20 days, and 5 supplementary days. The Mexicans had besides a ritual or religious year for the regulation of their festivals; and, by means of a cycle of 52 years, and a very complicated method of computation, the religious and civil periods were connected with one another, and the civil year was made to correspond with the natural by the intercalation of 13 days at the end of the cycle. The month was divided into four weeks of five days, but each day of the month had a distinct name; and Humboldt has given strong reasons for believing that these names were borrowed from an ancient zodiac formed of 27 or 28 lunar houses, which was made use of from the remotest antiquity in Tartary, Thibet, and India. The calendar of the Mexicans bespeaks a degree of scientific skill, and an accuracy of observation, which are not easily reconciled with their semi-barbarous habits, their general ignorance in other things, and the recent date of their civilization according to their own account. It is here, indeed, and not in their language, that we find distinct traces of their connection with Asiatic nations. The character of the Mexicans is probably the same at this day as before the conquest, which we are disposed to think, made less change in the situation of the people than is often supposed, though it annihilated the rank and privileges of the nobles. The Mexican Indian is grave, suspicious and taciturn; quiet and placid in his external deportment, but rancorous in his spirit; submissive to his superiors, harsh and cruel to those beneath him. His intellect is limited, and chiefly develops itself in imitative labors and mechanical arts. Slow, cautious, and persevering, he loves, both in his acts and thoughts, to travel in a beaten track. The people, though speaking many different languages, have nearly the same physical character. The Mexicans have olive complexions, narrow foreheads, black eyes, coarse glossy black hair, and thin beards. They are of the middle size, and well-proportioned in their limbs. A person with any defect or deformity is rarely seen amongst them. They are healthy, and live to an advanced age, when life is not shortened by drunkenness. The Toltec and Aztec races, when they established themselves in this country, diffused their own language partially from the Lake of Nicaragua to the 37th parallel. They reclaimed, by degrees, many of the neighboring savage tribes to a settled mode of life, and spread a feeble degree of civilization over a mixed mass of nations, speaking, according to Clavigero, 35 languages, of which Humboldt tells us that 20 still exist. The Aztec language is one of the most copious and polished of the American tongues, and abounds in words of the immoderate length of 12 or 15 syllables. It is uncertain what was the number of subjects over whom Montezuma ruled. The ruins in the valley of the Tenochtitlan, on which the capital now stands, show that it must have been more populous before the conquest than now; but the population at present is diffused over an incomparably wider space; and upon the whole, there are no good grounds for believing that the number of civilized Indians was much greater when Cortes landed, than in 1803, when it amounted to 2,000,000.

The civilization of Mexico, as well as of Peru, owed its existence to a single cause,—the patient, submissive, and superstitious character of the people, which fitted them to be beasts of burden, under an aristocracy of priests and nobles, who were led, perhaps, partly by influences from abroad, partly by the instinct of self-interest, to devise means for holding

the mass of the community in subjection. Many of the nations which continued savage, such as the Algonquins and Iroquois, were probably equal to the Mexicans in intellect; but their propensity to superstition was less, and their energy of character was too great to permit of their being enslaved by their chiefs. It is chiefly in the variety of their primitive character that we must seek for the cause of the diversity of manners and institutions we find among the American nations.

The ancient empire of Peru, more extensive than that of Mexico, embraced the whole seacoast from Pastos to the river Maule, a line of 2,500 miles in length. Its breadth is uncertain; but as it included both declivities of the Andes, it must have extended in some cases to 500 miles, and the entire surface of the empire probably exceeded 500,000 square miles. It is plain, however, from the imperfect history of the Incas which has been preserved, that within this space there were many districts where their authority was feeble, and others inhabited by tribes which were entirely independent. One part of the country, besides, consisted of a sandy desert, while the most elevated tracts were uninhabitable from cold. It must not therefore be supposed that the capacity of the country to support population was commensurate with the extent of its surface. Still the magnitude of the Peruvian empire, in the midst of an immense multitude of independent savage communities, so extremely minute, that a hundred of them might have been planted without crowding in one of its provinces, is an extraordinary phenomenon. The creating and maintaining of such an empire is a proof that the Peruvians had made no trifling progress in the useful arts and in the science of government. To keep in subjection so many remote provinces, there must have been an efficient military force, rapid means of communication, considerable revenues, and an organized magistracy capable of understanding and executing the plans of rulers, who had sufficient political skill and knowledge of human nature to adapt their institutions and arrangements to the wants, habits, and character of a great variety of dissimilar nations, spread over a territory reaching as far as from Lisbon to the banks of the Volga. It is clear that the ruling tribe, which was able to extend its dominion, and to a considerable extent its language, over a space of 25,000 miles, must have possessed a marked superiority of some kind over the hordes that surround it. We must remember, besides, that the Peruvians lay under the disadvantage of being destitute of even such an imperfect instrument of communication as the hieroglyphic language of the Mexicans, and that they were extremely deficient in military spirit. Indeed, it is one of the most singular facts connected with the history of America, that by far the largest empire it contained was formed by the most unwarlike people in it. The dominion of the Incas was founded entirely on policy, superstition, and the arts. It could only be by the intelligence and skill which civilization develops, that the Peruvians conquered tribes superior to themselves in courage; and it was by policy and superstition that the Incas tamed the rudeness of savage tribes, and held distant countries in subjection. Robertson justly observes that the Peruvians "had advanced far beyond the Mexicans, both in the necessary arts of life, and in such as had some title to the name of elegant." In two points only were they inferior; in their calendar or mode of computing time, and in their want of such a substitute for writing as the Aztecs possess in their hieroglyphics.

Agriculture was conducted with greater care and success in Peru than in Mexico. The lands capable of cultivation were divided into three shares. One was consecrated to the service of religion, the erection of temples, and the maintenance of priests; the second was set apart as a provision for the support of the government; and the third and largest share, which was reserved for the people, was parcelled out, not among individuals, but among the hamlets and villages according to the number and rank of the inhabitants; and a new division was made every year to meet any change that might arise in the circumstances of the parties. The members of each little community went to the fields under overseers, and cultivated the land by their joint labor. The produce was distributed among the families and individuals according to their wants, while the evils of famine were provided against by storing up the corn in granaries. The Peruvians having no draught animals, and no ploughs, turned up the earth with wooden mattocks; but their skill and care were exemplified in irrigation, which they practiced extensively, and in their employing as manure guano, or the dung of sea birds, which abounds on the island near the coast. Their masonry was superior to that of the Mexicans. Like the ancient Egyptians, they understood mechanics sufficiently to move stones of vast size, even of 30 feet in length, of which specimens are still existing in the walls of the fortress of Cuzco. They had the art of squaring and cutting blocks for building with great accuracy; and they did not effect their purpose, as Robertson supposes, merely by chipping the stones, or rubbing them together so as to fit the surface of the one to that of the other, without regard to symmetry of form. It is now known that they had hard chisels made of copper, with a mixture of 6 per cent. of tin,—a proof of considerable skill in the working of metals. With these they have hewed the stones into parallelopipeds, which were disposed in "courses as regular," says Humboldt, "as those of Roman workmanship." They are joined with such nicety that the line which divides the blocks can scarcely be perceived; and the outer surface is in some cases covered with carving. The palaces or lodges of the Incas, of which there are many remains, had doors with slanting sides like the Egyptian; sloping roofs, which, it is supposed, were covered with rushes or stone slabs; no windows, but niches symmetrically distributed. Ancient stone structures, which are so rare in Mexico, are pretty abundant in Peru,—a fact for which we can only account by the difficulty with which the Mexicans erected buildings, in consequence of their inferiority in the art of masonry. The architecture of the Peruvians, like everything else connected with their social state, displays a remarkable uniformity, not only of style, but of plan. "It is impossible," says Humboldt, "to examine a single edifice of the time of the Incas, without recognizing the same type in all the others which cover the ridge of the Andes, along an extent of 450 leagues."

The ancient public roads of Peru are justly considered as striking monuments of the political genius of the government. One of these extended along the sides of the Andes from Quito to Cuzco, a distance of 1,500 miles. It is about forty feet broad, and paved with the earth and stones which were turned up from the soil; but in some marshy places it is formed, like the old Roman roads, of a compact body of solid masonry. A tolerably level line is preserved by filling up hollows, cutting down small eminences, and winding round the sides of large ones. At proper distances *tambos* or *storehouses* were erected, for the

accommodation of the Inca and his messengers. A similar road was made along the coast in the low country. Fissures a few yards in breadth were passed by bridges formed of beams laid horizontally; and an invention, at once bold and ingenious, afforded the means of crossing deep ravines, or the channels of rivers, which happened to intersect the route. This consisted of a suspension bridge, perfectly analogous in its principle to those with which we are familiar. It was formed of half a dozen cables of twisted osiers, passed over wooden supports, and stretched from bank to bank; then bound together with smaller ropes, and covered with bamboos. Humboldt passed over one of these pendulous bridges, of 120 feet span; and Mr. Miers crossed one of 225 feet span, over which loaded animals might travel. In low grounds the rivers were crossed on rafts with a mast and sail, which, by a particular contrivance, could be made to tack and veer. In this respect the Peruvians were a stage in advance of all the other American races, who had nothing superior to the canoe with paddles. The Peruvians manufactured a rude species of pottery; they understood the art of spinning, and, in an imperfect degree, that of weaving. They procured native gold by washing the gravel of rivers; and silver, and perhaps copper, by working veins downward from the outcrop. They knew how to smelt and refine the silver ore; and they possessed the secret of giving great hardness and durability to copper by mixing it with tin. Their utensils and trinkets of gold and silver are said to have been fashioned with neatness and even taste. On the other hand, they had no money, no knowledge of iron or glass; and they were ignorant of the mode of mortising or joining beams, and of casting arches. They had no animals fitted for draught; but the llama, a small species of camel, which they had tamed, was employed to some extent as a beast of burden.

The political organization of Peru, which was artificial in a high degree, reminds one, in some of its features, of the old system of the Saxons in England, but bears a more general resemblance to that of the ancient Egyptians. The mass of the people were in a state of servitude, except a small number, who were free; above these in rank were the Curacas, or chiefs of districts, who formed a sort of nobility; and above the whole, the family of the Incas, the members of which, by intermarrying only with themselves, formed a numerous and distinct caste. For the purposes of police and civil jurisdiction, the people were divided into parties of ten families, like the tithings of Alfred, over each of which was an officer. A second class of officers had control over five or ten tithings, and a third class over fifty or a hundred. These last rendered account to the Incas, who exercised a vigilant superintendence over the whole, and employed inspectors to visit the provinces as a check upon maladministration. Each of these officers, down to the lowest, judged, without appeal, in all differences that arose within his division, and enforced the laws of the empire, among which were some for punishing idleness, and compelling every one to labor. It is probable that the tithings and hundreds, as in England, would lose their numerical signification in course of time, and become mere local allotments. In the hamlets and villages a person mounted a tower every evening, and announced where and how the inhabitants were to be employed next day. The taxes were paid in the produce of the fields, and magazines for receiving them were established in every district. Such is the account given by Acosta and Garcilasso of the civil institutions of Peru, which may be correct

with regard to the oldest possessions of the Incas near Cuzco, where their power had been long established; but it is not probable that such a complicated system was ever fully in operation in the more distant parts of the empire.

The government of Peru was a theocracy. The Inca was at once the temporal sovereign and the supreme pontiff. He was regarded as the descendant and representative of the great deity the sun, who was supposed to inspire his counsels, and speak through his orders and decrees. Hence even slight offenses were punished with death, because they were regarded as insults offered to the divinity. The race of the Incas was held sacred. To support its pretensions, it was very desirable that it should be kept pure and distinct from the people; but human passions are often too strong for the dictates of policy; and, though the marriages of the family were confined to their own race, the emperor, as well as the other males of the blood royal, kept large harems stocked with beauties drawn from all parts of the empire, and multiplied a spurious progeny, in whom the blood of the "children of the sun" was blended with that of the "children of the earth." Among a simple-minded and credulous people the claims of the Incas to a celestial origin seem to have been implicitly believed. They were blindly obeyed, and treated with a respect bordering on adoration, by the nobles as well as the common people. The Peruvians worshipped the sun, the moon, the evening star, the spirit of thunder, and the rainbow, and had erected temples in Cuzco to all these deities. That of the sun, which was the most magnificent, had its walls covered with plates of gold. The sacrifices consisted of the objects most prized by the people, of grain and fruits, of a few animals, and of the productions of their own industry. Sabanism, as it is the most rational of all the forms of idolatry, is also generally the most mild; and doubtless this results from the tendency which it has to fix the thoughts on the marks of beneficence and wisdom which are displayed in the works of nature. The Peruvian temples were accordingly never polluted, like those of Mexico, with the blood of human victims; and the Incas even went farther and signalized their zeal against such horrid rites, by suppressing them in all the countries they conquered. Though their history exhibits some bloody deeds, the general character of their government was the reverse of cruel. The severe punishments prescribed by their laws were rarely inflicted, and rebellion was scarcely known in their dominions. The Inca not only assumed the title of the father of his people, but the vices as well as the merits of his government sprang partly from the attempt made to construct the government on the model of paternal authority, and partly from the blending of moral and religious injunctions with civil duties. Hence the idle pretension of the state to reward virtuous conduct, as well as to punish crimes; hence too the plan of laboring in common, the extinction of individual property, the absurdities of eating, drinking, sleeping, tilling, building, according to fixed universal rules; in fine, that minute and vexatious regulation of all the acts of ordinary life, which converted the people into mere machines in the hands of an immense corps of civil and religious officers.

This system of the Peruvian monarchs, by which the people were kept in a state of perpetual tutelage, merits the greater attention, because it is precisely that which the Jesuits employed, in Paraguay and other districts, to reduce the natives to a settled mode of life; and it seems, in fact, to be the only method by which a semblance of civilization can be intro-

[illegible]





NORTH AMERICA

English Miles

100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000



duced amongst the American nations. Two things must be supposed to account for its prevalence; first, a certain amount of timidity, passiveness, and superstition, in the body of the people, implying weak passions, but not necessarily smallness of intellect; and, secondly, a few minds of a higher class, to give an impulse to the rest, and to control and regulate their acts. In the case of Peru, did these ruling intellects spring from the body of the people, and, after striking out new lights in morals and legislation for themselves, devise a complex and artificial system for establishing their power over the minds of the rest, by the help of superstition and force, or were they strangers from another country, and imbued with the principles of a higher civilization? If we may believe the Peruvian annals, the latter was the case. About the year 1000 of our era, or perhaps a century later, Manco Capac, with his wife and sister Mama Ocello, appeared as strangers on the banks of Lake Titicaca. They were persons of majestic appearance, and announced themselves as "children of the sun," sent by their beneficent parent to reclaim the tribes living there from the miseries of savage life. Their injunctions, addressed to a people who probably worshipped the god of day, were listened to by a few, who settled around them, and founded Cuzco. By degrees, other tribes were induced to renounce their wandering habits. Manco Capac instructed the men in agriculture and the arts, and Mama Ocello taught the women to spin and to weave. Laws, institutions, and religious rites were added. The form of a civilized society arose, which was gradually extended by persuasion or conquest,—the Incas having always planted their arts and religion wherever they established their authority. Huayna Capac, the twelfth in succession from the founder of the dynasty, occupied the throne when the first party of Spaniards visited Peru in 1527, and the empire was then still in a state of progress. There is, however, little doubt that some advance in civilization had been made in times before the Incas.

Such is the account which the Peruvians give of the origin of their civilization, which we should be disposed to reject as a fable, if there were not peculiar circumstances which give it some credibility. First, their institutions, taken in the mass, do not present what may be called the American type. The mild and paternal character which they display, the injunction to "love one another" raised to the rank of a positive precept, the preference of the useful arts to war, all breathe a spirit, not only foreign to the genius of the American tribes, but exactly opposed in character to anything which a native self-taught legislator was likely to produce. Secondly, the artificial and systematic form of the Peruvian institutions renders it improbable that they were developed by the natural action of political causes, but strongly favors the idea that they were framed by a few designing heads as an instrument to tame and govern a patient, feeble, and credulous people of rude or savage habits. A small number of Jesuits were led, by a sagacious study of the savage character, to devise a system extremely similar in its nature, which worked admirably. These missionaries were the Manco Capacs of Paraguay; and, like the Incas, might in the course of two or three centuries, have extended their theocracy over as large a space as Peru, if their situation had permitted them to employ force. Thirdly, a million of native Peruvians yet survive, the living descendants of those who built the temples of Cuzco; and their extreme stolidity, apathy, and feebleness of character sufficiently testify that the chances were nearly as great against a legislator

like Manco Capac arising amongst them, as against the Jews in the time of Augustus producing a being like Napoleon. They have the weakness and passiveness which fit them to receive an impression from superior directing minds; but they discover no trace of the intelligence, energy, and originality which must have been united in the persons who planned and carried into effect the political system of the Incas. We admit that depression may have degraded their character, but it cannot have entirely changed it.

If, then, the civilization of Peru was exotic, whence was it derived? To us it appears most probable that the legislators of Peru were either Chinese, or persons who had received at second-hand a knowledge of the arts and institutions of China; and our opinion is grounded on traits of resemblance in the manners, laws, arts, and institutions of the two nations, which, in our opinion, are two numerous, striking, and peculiar, to be the effect of chance. We shall mention some of the most prominent.

1. The first and most obvious resemblance is in the singularly artificial frame of society in both countries. In China, as in Peru, the legislation is *directive* as well as punitive, and is distinguished by that minute and elaborate system of regulation, inspection, and control which interferes with the most trifling actions of ordinary life, and reduces the mass of the people to the condition of automata, moved and guided in everything by the rulers. China, says Mr. Barrow, is a great school, in which the magistrates are the masters, and the people the scholars. It might be more correctly compared to a large monastic establishment, in which each person has his place and his duty assigned to him, and all his acts directed by superiors, whose wisdom and authority he is not permitted to question. The Chinese have the same immense multitude of civil officers which the Peruvians had, and the same chain of subordination from the emperor down to the petty constable. In China the system was undoubtedly the growth of many centuries; but it was too artificial to occur to the thoughts of a cacique, educated amongst a tribe of savages on the sides of the Andes.
2. In China, as Peru, the emperor assumes the title of the "father of his people;" and the government is modelled upon this figure of speech. He affects to be sprung from progenitors who descended from heaven like the children of the sun, and he unites the character of supreme pontiff with that of temporal prince. There are vestiges, too, of the worship of the heavenly bodies in China.
3. The Chinese emperor extends an ostentatious patronage to agriculture by celebrating an annual festival in its honor, on which occasion he proceeds to the field in great pomp, and takes a part in the labor of cultivating the ground with his own hands. This singular custom existed in Peru, where the Incas went through an annual ceremony perfectly similar. How foreign was such an institution to the spirit of the American tribes?
4. In China agriculture is in a rude state, and exhibits proofs of intelligence and skill only in two things—the use of manures, and a laborious system of irrigation. Precisely the same circumstances characterized the agriculture of Peru.
5. The internal taxes of China, like those of Peru, are paid in kind (maize, rice, silk, cotton, etc.), and stored in public magazines or granaries.
6. The Chinese government maintained public roads, even in those provinces where neither carriages nor beasts of burden were used, of course for the use of pedestrians, and storehouses or places of refreshment were built upon them at proper distances. The Peruvians constructed roads on precisely the same

plan, and for the same purposes; and this was done by no other people in America. 7. The Chinese do not inter the bodies of the dead, but lay them on the ground and raise a tumulus or conical heap of earth over them. Such was also the practice in Peru. The only barbarously cruel rite practiced in Peru, that of immolating the Inca's domestics at the obsequies of their masters, was brought into China by the Tartars. Its existence is an anomaly in each case, for the genius of both nations was peaceful and mild. 8. The architecture of the Chinese displays little taste, but is distinguished by two peculiarities—the power shown of cutting and moving immense masses of stone, and the uniformity of style which pervades their structures, of every size and description. "All the buildings," says Mr. Barrow, "from the meanest hut to the viceroy's palace, are upon one plan." Humboldt remarks the same adherence to a single model among the Peruvians, and the walls of Cuzco show that they were acquainted with the method of moving stones of prodigious size. The Chinese were fond of covering their walls with carving, and examples of the same practice occur in Peru. If any of the Peruvian buildings had remained entire with their roofs on, it would perhaps have been found that the type or primary architectural form employed in the two countries was not very dissimilar, and some allowance should be made for the circumstances, that Peru must have borrowed her models from China 700 or perhaps 1,000 years ago. 9. The Peruvians made coarse pottery, and all the world knows that this is an art in which the Chinese excel. The Peruvians were the only American nation who had made any progress in the art of fusing and alloying metals, in which the Chinese have long been distinguished by their skill. 10. The Peruvians had dramas and dramatic spectacles. Whence could a people so uninventive have derived the idea of such entertainments, if not from China, where they have been long familiar to the people? There were mimics and buffoons in Mexico, but nothing, we believe, to which the term drama could be applied. 11. But perhaps the most remarkable coincidence is found in an invention entirely confined to the two countries. We have described the suspension bridges made of ropes, employed by the Peruvians in crossing deep ravines. Now, it is singular that bridges of the very same description, some of chains, and some of ropes, are found in the south of China, and nowhere else except in Thibet, which has interchanged arts and customs with China from time immemorial. This single fact we would consider as a proof of communication between the two countries. The Peruvians made their ropes of twisted osiers, and the Chinese had also ropes of this description. 12. From what people nearer than the Chinese could the Peruvians borrow the idea of rafts with a mast and sail? These rafts, supporting covered huts, may be considered as literal copies of some that are used in China; and the peculiar mechanism employed in lieu of a rudder is no doubt borrowed from the paddles attached to the Chinese boats, fore and aft. 13. The Chinese in ancient times made use of quipus or knotted cords to facilitate calculation. Is it not probable that this invention had passed from them to the Peruvians, the Mexicans, the Kaluschi, and other American nations who employed it? It would be easy to trace similar analogies in many other customs, laws and institutions of the two nations. Both had nunneries or religious societies of women, who lived under a vow of celibacy; both had a class of literary men (the Haravecs and Amautas, or poets and philosophers, in Peru), patronized by the government; both divided the year into

twelve months, and placed the beginning of it in January (a coincidence the more remarkable, as the year of the Mexican and other northern nations consisted of eighteen months); both were strangers to the use of milk, cheese, and butter. Our position is not that the Peruvians are descended from the Chinese, but simply that Peru has been inoculated with civilization by persons who derived their ideas from China. If it be asked why these persons did not import from China the use of letters, the method of casting arches, and many other arts practiced there, our answer is, that no individual, and still less any casual assemblage of individuals such as the purposes of trade and navigation might bring together, possesses a knowledge of every art and science which exists in his country.

The Quichua language, or that of Peru, was spread, by the care of the Incas, over all the countries which they conquered, so far at least as to be understood, if not spoken, by the great variety of tribes subject to their sway. It is understood at present as far as Santiago del Estero, 1,200 miles of direct distance southeast from Cuzco. This single fact proves both the long duration of their power, and the efficiency of their internal administration. It is said to be the most rich, polished, and harmonious of the South American languages, abounding in vowel sounds, but wanting those corresponding to the Spanish consonants *b, d, f, g, l, x, v*. About ten years ago a copy of an old MS. was discovered, which contained an account of the Maya alphabet of Yucatan—the only alphabet yet known to have existed in America.

The Peruvians of the aboriginal Quichua race are of a copper color, with a small forehead, the hair growing on each side from the extremities of the eyebrows; they have small black eyes, a small nose, a moderately sized mouth, with beautiful teeth; beardless chin (except in old age), and a round face. Their hair is black, coarse, and sleek, the body well proportioned, the feet small, the stature rather diminutive. Their intellectual qualities, according to M. Ulloa, are of the lowest order. The most prominent trait in their character is an imperturbable and incurable apathy. Though half-naked, they are as contented as the Spaniard in his most splendid raiment. Gold and silver have so little influence over them that the greatest recompense will not induce them to perform the slightest service voluntarily. Neither power nor dignity moves them, and they receive with the same indifference the office of alcalde and that of executioner. They are habitually slow in their motions, and extremely indolent. When employed at any piece of labor, if the master withdraw his eye for a moment, they cease to work. They are timid, shy, secretive, and always grave, even in the dances, which are their favorite pastime. The love of intoxicating liquors is deeply rooted in their nature. They prepare a fermented beverage called chicha from maize, by a process known to them before the conquest, and at their festivals drink till their senses fail them, day after day. This vicious habit, however, is common to all the American nations, and is confined to the men, for the women are in general strictly sober. The Peruvians are a gentle and mild people; they are fond of their dogs, and breed up hogs, geese and chickens, for which they have so tender a regard, that they will often neither kill nor sell them. Their huts, says Mr. Stevenson, consist of stones laid upon one another without any cement or mortar, thatched over with long grass or straw, affording no defence from either the wind or the rain. One small room contains the whole family; their bed a sheep-skin or two; their furniture one or two earthen pots. The principal food

of the Peruvians is maize; but they raise also potatoes, wheat, beans, tomatoes, yucas, pumpkins, and other vegetables. Christianity, imposed upon them dogmatically by priests who take no pains to enlighten them, has scarcely gained admission to their understandings, and has no hold on their affections. They attend divine service from the dread of chastisement, and give an outward assent to whatever they are taught, but without any real religious impression being made upon their minds. They meet death with the same stupid indifference as the ordinary accidents of life, and rather decline than seek the assistance of a priest in their last hours. It ought not to be forgotten, however, that the intellectual torpor which the Peruvians display may be attributed in part to the deadening and debasing effects of three centuries of brutal oppression. They still cherish in secret a strong veneration for their ancient faith and their native government, which displays itself even in the large towns. The story of Manco Capac (whom, since numbers of our countrymen appeared in Peru, they affect to call an Englishman) and Mama Ocello, the wealth, power, and beneficence of the Incas, are still fresh in their memories, and are handed down from father to son with a degree of fond admiration which three centuries of humiliation and misfortune seem only to have rendered more intense. The barbarous murder of the Inca Atahualpa by Pizarro is annually represented in the form of a tragedy. "In this performance," says Mr. Stevenson, "the grief of the Indians is so natural, though excessive, their songs so plaintive, and the whole is such a scene of distress, that I never witnessed it without mingling my tears with theirs. The Spanish authorities have endeavored to prevent this exhibition, but without effect. The Indians in the territory of Quito wear black clothes, and affirm that it is mourning for their Incas, of whom they never speak but in a doleful tone."

The oppression of the *mita*, or forced labor in the mines, with the introduction of the small-pox and the use of spirituous liquors, has destroyed prodigious multitudes of the Indians since the conquest. What their number was before that event it is impossible to tell; but, judging from the extent of the Inca's dominions, he probably had not less than three or four millions of subjects. A pretended Spanish account, assigning a population of eight millions to Peru shortly after the conquest, is known to be fictitious. An official estimate in 1889 made the number of Indians in Peru amount to 1,600,000, being three-fourths of the entire population.

In Chili there were several tribes who possessed nearly all the arts known to the Peruvians, but were distinguished from them by a finer physical constitution and an unconquerable spirit. When the Spaniards arrived, Chili, according to Molina, was inhabited by fifteen tribes independent of each other, who were spread over the country on both sides of the Andes, from latitude 30° to the Straits of Magalhaens. They all spoke dialects of one language, which is described as rich, harmonious, abounding in compound words, and having, like the other American tongues, very complicated grammatical forms. It has no affinity to the Quichua or Peruvian. The inhabitants of the plains are a stout people, of middle stature; those of the mountains are tall; and one tribe, the Tehuels or Patagonians, surpass in size every other nation in the world. All the tribes inhabiting the plains, except those of the extreme south, now make use of horses. The complexion of the Chilian tribes is, like that of the other American nations, a reddish brown; but one tribe is said to be of a clear red and white.

They do not paint their bodies. The Chilians lived partly by hunting, but chiefly by agriculture, before they had any intercourse with Europeans. They cultivated maize, magu, gugen, tuca, quinoa, the potato, pumpkins, and some species of pulse; and to these they added, as food, the flesh of the bizcacho, and of the llama or Araucanian camel, of whose wool they are said to have manufactured cloth. Like the Peruvians, they understood the use of manure, practiced irrigation with considerable skill, and turned up the ground with a wooden spade or mattock. They boiled their grain in earthen pots, or brayed it into meal after roasting it in hot sand; of the meal they made puddings or bread, which they knew how to leaven, and various species of fermented drink. They had gold, silver, copper, tin, and lead, procured probably by washing; but they seem to have had few or no edge-tools of metal, those found being almost always of basalt. They made baskets and mats, extracted salt from sea-water, and were able to give various dyes to their cloths. They used *quipus* or knotted cords for calculation, and, according to Mr. Stevenson, for the transmission of intelligence and for recording events. They lived in villages formed of houses standing at a distance from one another, under hereditary chiefs, but whose power was limited. It is remarkable that the Chinese mode of catching wild ducks on the rivers, by covering the fisher's head with a gourd, was practiced in Chili.

The Araucanians, the most intelligent, improved, and warlike of the Chilian tribes, occupy about 200 miles of the seacoast, between the 37th and 39th parallels. They are of ordinary stature, but vigorously formed; bold, hardy, hospitable, faithful to their engagements, generous to a fallen enemy, ardent, intrepid, and enthusiastic lovers of liberty. Their vices are drunkenness, and a contempt of other nations, springing from pride. Their government, in the regularity of its form and its sub-division of authority, has an outward resemblance to the Peruvian; but the spirit of the two systems differs as widely as the genius of the two nations. Araucania contains four tetrarchies, under four *toquis* or princes, who are independent of one another, but confederated for their joint security against foreign enemies. Each tetrarchy is divided into five provinces, ruled by five chiefs called *apo-ulmen*; and each province into nine districts, governed by as many *ulmen*, who are subject to the *apo-ulmen*, as the latter are to the *toquis*. These various chiefs (who all bear the title of *ulmen*, as the nobility of all orders are barons) compose the aristocracy of the country. They hold their dignities by hereditary descent in the male line, and in the order of primogeniture. The supreme power of each tetrarchy resides in a diet or great council of the *ulmen*, who assemble annually in a large plain, like the Poles and Germans in old times; but as the people are all armed, and have a high love of liberty, no resolution of the diet is of any avail if it has not their hearty concurrence. The chiefs, indeed, are little more than leaders in war; for the right of private revenge, which is fully admitted, limits their authority in judicial matters; and they receive no taxes. Their laws are merely primeval usages. The Araucanians can raise altogether 6,000 or 7,000 men, besides a body of reserve. When war is declared by the great council, messengers bearing "arrows, dipt in blood" are sent to all parts of the country to summon the men to arms. Unlike many barbarous nations, which are immovably attached to their ancient customs, the Araucanians were not slow in copying the military arts and tactics of the Span-

iards. Their troops now consist of infantry and cavalry; the former armed with pikes and clubs, the latter with swords and lances. The infantry are formed into regiments of ten companies, each company containing a hundred men. When they take the field, they carry parched meal with them for provisions; they station sentinels, send out scouts, and have advanced guards preceding their main body. When necessary for their security, they dig ditches, and plant stakes along their sides, and throw up mounds of earth. They advance to battle in lines, well formed, and fight with intrepidity. Their history affords a brilliant example of what a brave nation, animated by an enthusiastic love of liberty, can accomplish under the greatest disadvantages. After resisting the best troops and the best generals of Spain for two hundred years, they at last compelled their proud enemies to acknowledge their independence. The Araucanians were indebted for their success to a deliberate species of courage, to which even the bravest of the North American tribes are strangers; and they combined with it a degree of sagacity and intelligence which led them to adapt their mode of fighting to the new circumstances in which they were placed. Experience having taught them the inefficiency of their old missiles when opposed to musket balls, they soon laid aside their bows, and armed themselves with spears, swords, or other weapons fitted for close combat. Their practice was to advance rapidly within such a distance of the Spaniards as would not leave them time to reload after firing. Here they received without shirking a volley, which was certain to destroy a number of them, and then rushing forward in a close column, fought their enemies hand to hand. In this way they gained many victories, and impressed the Spaniards with such respect for their courage that an individual of that nation made their achievements the subject of an epic poem. Combining the moral intellectual, and physical qualities of the Araucanians, they were certainly the finest native race in the New World. They had nearly all the germs of civilization which belonged to the Mexicans and Peruvians, without the ferocity of the former, the apathy of the latter, or the lavish habits common to both; and without having their minds stupefied by that grovelling superstition which the rulers of these two nations seem to have considered as the only secure foundation of their authority. In true courage, in manliness and energy of character, they take precedence of all the American nations.

The Araucanians believe in a supreme being, and in many subordinate spirits, good and bad. They believe also in omens and divinations, but they have neither temples nor idols, nor religious rites; and discover upon the whole so little aptitude for the reception of religious ideas that the Catholic missionaries, who have settled among them, have had very little success in imbuing their minds with a knowledge of Christianity. They believe in a future state, and have a confused tradition respecting a deluge, from which some persons were saved on a high mountain. They divide the year into twelve months of 30 days, which have significant names, and add five days by intercalation. They esteem poetry and eloquence, but can scarcely be induced to learn reading or writing. Chess, a game of oriental origin, is said to have been known among them from time immemorial; and it may be further observed, that the numbers 5 and 9, employed in their geographical and civil divisions, are favorite numbers in China.

The other Chilean tribes are all much behind the Araucanians in civilization; but some, as the Puelches

and the Tehuels, surpass them in strength and stature. Part of them live on horse flesh, part by keeping sheep and cattle, and part by hunting. Some of these tribes paint their faces. They dwell in tents and lead a wandering life.

Of the numerous nations that inhabited Brazil there is only one to which we can afford any special notice in this article. The Guarani have at one time formed a numerous people, which seems to have been spread over a larger surface than any other now existing in America. Tribes, or remnants of tribes, whose relationship to the Guarani is attested by the strong evidence of their language, are found diffused over the wide space between the Orinoco and the embouchure of the Plata, or more than the half of South America. They are met with among the Andes of Peru, in the province of Chiquitos, in Matto Grosso, in Paraguay, in Minas Geraes; and the Omaguas, in the republic of Ecuador, who, from their nautical habits, and the influence they obtained on the upper part of the Amazon, have been called the Phœnicians of the New World, are believed to be of the same race. They constituted the bulk of the native population of Brazil when the Portuguese gained possession of it, but were divided into many distinct tribes, quite independent of one another, and living, not in contiguity, but mixed with other nations. They are of low stature, two inches shorter than the Spaniards, according to Azara; of a square form, fleshy and ugly. Their color has a strong shade of the copper red, while that of the other Brazilian tribes inclines generally to the tawny or black. Their character, like their physical form, resembles that of the Peruvians. They are patient, torpid, silent, downcast in their mien, mild and passionless. Nearly all the Indians whom the Portuguese have civilized or converted belong to this race. It is difficult to account for their dissemination through the southern continent, amidst nations much more brave and powerful than themselves. We may suppose that, like the subjects of the Incas, they have been at one time the dominant tribe of an extensive empire, which derived its force from union and civilization. But if such a state did exist, its date cannot be very ancient; for the identity or close resemblance of the dialects spoken by the scattered portions of the Guarani shows that their dispersion from a common point did not happen at a very remote period. Yet no memorial of its existence survives, either in traditions or monuments. The supposition, therefore, that the Guarani tribes are the remnants of a once powerful and united people, is scarcely admissible; and Azara thinks it more probable that they have crept gradually from north to south. Their dispersion is the more remarkable, as they are not a wandering but an agricultural people. They live in the woods, or in small open spaces in the forests; cultivate maize, beans, gourds, yams, mandioc; and eat also wild honey, and the flesh of monkeys and various small quadrupeds.

The Indians whom the Jesuits civilized and collected into communities in the celebrated settlements of Paraguay belonged chiefly to the nation of the Guarani. These missionaries are said to have borrowed the plan of the theocracy which they established here from that which the Incas had introduced into Peru. There is no doubt that the spirit of their system was the same; and, considering that they were precluded from any other means of extending and supporting their authority than persuasion, their success was remarkable. The settlements were commenced about 1610, and were gradually extended over the country

watered by the Parana and Uruguay, between the 27th and 30th degrees of south latitude, till the order of the Jesuits was suppressed in 1767. The plan of the government may be called *parochial*, for it was administered entirely by the parochial clergy. The Indians were collected into villages. Each village had its church and its curate, who was assisted by one, two, or more priests, according to the number of Indians under his charge. The curate and assistant priests were nominated, not by the Spanish authorities, but by the father superior, also a Jesuit, who exercised a vigilant superintendence over the whole. Indians were appointed in each village with the titles of regidores and alcaldes; but they were merely instruments in the hands of the curate and his assistants, in whom all power was lodged. The curate gave his whole attention to religious offices, saying mass in the church, and visiting the sick; while the assistant priests managed all secular matters, directing the labor of the Indians who cultivated the grounds and training others to the crafts of the weaver, mason, carpenter, goldsmith, painter, and sculptor; for the fine arts were by no means neglected. Private property did not exist. The produce of the labor of the community was stored in magazines, from which each family was supplied according to its wants, special provision being made for aged persons; widows, and orphans. The surplus was sold by agents in Buenos Ayres, and the proceeds employed in paying the taxes to the king, in procuring ornaments for the churches, and various articles which the colonists could not manufacture for themselves. The religious instruction was of the most simple kind; but the service of the church was conducted with a well-trained choir, a pompous ceremonial, and every accessory calculated to strike the senses. The punishments were mild; and they were always accompanied with such admonitions as a parent would address to a child whom he was chastising. Crimes, in truth, were rare. The Indians, who regarded their spiritual chiefs with the veneration due to beneficent beings of a superior order, scarcely felt humbled in confessing their misdeeds; and offenders may have solicited correction, as Raynal says, for the quieting of their consciences. The incursions of the Portuguese compelled the Jesuits to take means to repel force by force. All the male Indians of the proper age were accordingly armed with muskets, and disciplined as a militia. In 1732, according to Dobrizhoffer, the thirty villages or parishes under the care of the missionaries contained a population of 141,000 souls. The Jesuits had another establishment of the same kind among the Chiriguas, a branch of the Guaranis, in the province of Chiquitos, containing 30,000 or 40,000 Indians; a third, of smaller size, in the province of Moxos; a fourth in California; and probably others. After the suppression of the order, all these were committed to the care of friars of other communities; and we believe they have universally fallen into a state of decay. The social system established in Paraguay was the most effectual ever contrived for reclaiming the Indians from their savage mode of life; but even its success shows how hopeless the attempt is to raise the American tribes to the rank of thoroughly civilized nations. The Jesuits were able to introduce settled habits and a slight knowledge of religion and the arts among the Indians only by means of the personal ascendancy they acquired over them. It was a few superior minds gaining the respect and confidence of a horde of savages, then employing the influence they acquired to lead them as children; giving them such portions of instruction as taught them to trust implicitly in their guides, working alternately

on their fears, their pride, their kind affections, but never fully revealing to them the springs of the machinery by which they were governed. The incurable indolence of the savages rendered it necessary to prescribe the labor as task-work, and to carry it on under the constant inspection of the missionaries. The plan of cultivating the ground in common, and of storing the produce in magazines, out of which the wants of each family were supplied, was resorted to as a check upon their improvident habits. In short, the eye and the hand of the missionaries were everywhere; and the social system was held together entirely by their knowledge and address. When these were withdrawn, the fabric soon fell into ruins, and the Indians relapsed into their idolatry and savage habits.

To complete our general view of the aboriginal races, a few particulars remain to be mentioned. Many of the tribes who inhabit the Pampas of South America make use of horses. Dobrizhoffer enumerates eight equestrian tribes in the province of Chaco, on the west side of the river Paraguay, who are generally distinguished by tall and vigorous forms, and a bold and active character. The Abipones and Mbayas are the most celebrated of these. The woods of Brazil are too dense for equestrians; but horses are used by a few hordes in the great plain of the Mississippi and in the north of Mexico. The American tribes in general either kill their prisoners or adopt them; but a few retain them as slaves, and compel them to work. The Guaycurus of Brazil are an example. The foods of different tribes are extremely various. Maize, beans, pumpkins, and mandioc are raised in small quantities by some; natural fruits, berries, bulbous roots, and bananas are gathered by others. Those who dwell on the sides of rivers live greatly on fish; in the plains, buffalos, horses, and sheep are killed. In the forests of Brazil, monkeys, pigs, armadillos, pacas, agoutis, and tapirs are the favorite food; but birds, turtles, deer, and the coati are also taken; and in an emergency the Indians do not scruple to feed on serpents, toads and lizards, the larva of insects, and other disgusting substances. Salt is used where it can be easily obtained, and some season their food with capsicum. Some roast their meat, others boil it; and not only several savage tribes, but even the civilized Peruvians, eat their flesh raw. The Ottomaques, a tribe near the Orinoco, eat a species of unctuous clay; this strange diet, which, no doubt owed its introduction to the stern monitor famine, is not extremely rare in Brazil, and Captain Franklin found the same food in use among an Indian tribe near the Frozen Ocean. The clay is stated by that traveller to have a milky and not disagreeable taste. A great proportion of the tribes in Brazil and the basin of the Orinoco, and some in other parts of America, indulge in the horrid banquet of human flesh. Shame, in our sense of the term, is nearly a stranger to the breasts of these savages. In the warm regions of Brazil men and women go entirely naked, except in the neighborhood of the Portuguese settlements, where some wear a band of cloth round the loins. In such situations where the want of shelter is little felt, their dwellings are often nothing more than a sort of arbor formed by interlacing the open space between two or three trees with twigs, and covering it with leaves so as to form a screen on the windward side, while it is left entirely open on the other. The manufacture of bows and arrows, war-clubs, baskets, mats (which, swung from a tree, serve them both as seats and hammocks), and in some cases a coarse pottery, comprises the sum of their practical skill in the arts. It has long been the practice of

bands of Portuguese, consisting chiefly of outlaws and vagabonds, to make marauding expeditions among the Indians living near the great rivers, and to carry them off and sell them clandestinely for slaves. This infamous trade is carried on in despite of the orders of the government, which has issued many decrees for the protection of the Indians, and, besides employing missionaries to convert them, enjoined the governors of provinces to furnish them with hoes and other agricultural implements.

As regards the region of Central America, a large proportion of the manuscripts of the natives was destroyed, so that now we are unable to acquire so full and accurate a history of the more civilized nations as we might otherwise have done. The literature which still exists, together with the numerous remains of cities, temples, roads, bridges, and other works of art, testify to the general truth of the historical narratives. However obscure they may now be, or however difficult the reconciliation of statements, it seems clear they have been founded on facts. As in the case of other histories, there is much error and tradition, mingled with truth, which render their correct interpretation difficult. Amongst some of the nations we know that historians were appointed by the government, and that such historians were severely punished if they ventured to tamper with the truth wilfully. It is stated that many centuries before the Christian era, Votan, the oldest of the American legislators, established himself in the region watered by the rivers Tabasco and Usumasinta. It is near the sources of this latter river, in the highlands of Vera Paz, that cities of civilized Indians still exist, according to travellers who have recently visited the adjoining districts. However this may be, this river was the principal highway into the interior of Central America for the earliest civilized tribes, as it is now for the existing natives. Near the mouths of the rivers mentioned the ground is scarcely above the level of the sea, and is for the most part a recent alluvial formation. During the rainy season it is covered with water, and all intercourse between village and village takes place by water. Just where the land acquires a slight rise, Palenque, said to be the oldest city in Central America, was founded. At that time, according to tradition, the low land was occupied by a lake. Votan, it seems, came from some foreign land, and found the whole of the country from Darien to California occupied by a barbarous people, who used the skins of wild beasts for clothing, caverns and huts made with branches for shelter, and wild fruits and roots, with raw flesh for food. Votan announced to these people a knowledge of the Supreme Deity, who was at first worshipped as the God "of all truth." At first no temples or altars were dedicated to him, and it was not until long after that Nezahualcoyotl erected a *teocalli*, or "house of God," as it means in the Mexican language, and dedicated it "to the unknown God." At a later period the religious ideas were considerably debased. In Votan's time there seems to have been but one language prevalent over a large area, and this language was probably the Maya, which is the stock of many of the languages formerly in use among the natives, and is still the language of Yucatan. The people apparently formed tribes differing somewhat in manners, the most prominent of which tribes are referred to as the Quinames or giants. Votan and his companions arrived in large ships, wore long flowing garments, and spoke the Nahuatl language. These strangers married the daughters of the country, and established a settled form of government. According

to one document, the year 955 B.C. is assigned to these events; but it is quite impracticable to give any trustworthy fixed date. Votan, it is said, wrote an account of the origin of the Indians, and of their immigration into America. He attempted to prove that they were the descendants of Imos, of the race of Chan, or the serpent. Votan made four voyages to his original country, and described the route he followed. On one of these voyages he visited the dwelling of the thirteen serpents, as also the ruins of an old building which had been erected by men for the purpose of reaching heaven. The people who lived in its vicinity told him it was the place where God had given to each family its particular language. Allusion is also made by him to certain mysteries like those of Egypt and Greece, of which traces were still made discoverable amongst the civilized nations of America. On returning from his first voyage to his native country he found the people at Palenque had attempted to usurp his authority and overturn his power. Thereupon he parted his monarchy into four divisions. One of these had for its capital the town of Tulha, the ruins of which may be seen near Ocosingo in Chiapa. Votan also is the reputed founder of Tsequil, which was afterwards called Ghowel, and the site of which is now occupied by a suburb of Ciudad Real. Some time, possibly not many years, after Votan, Zamna appeared in Yucatan. He introduced the Maya civilization, founded the town of Mayapan, and called the country Mayaha, or the land without water, a term well applied to the extremity of the peninsula of Yucatan, where rivers are almost absent. Mayapan was once the capital of Yucatan, and in Zamna's time the sea covered the country to within a short distance of it. He lived to a great age, and during the later years of his life dwelt on the seacoast, and was buried at this place. The spot became the site of a large temple erected to his honor, which was visited by pilgrims from great distances. A town sprung up around it called Itzamal, which is believed to correspond with the modern Isamal, now about 30 miles distant from the sea. The region to seaward is reported to be geologically very recent as land, and the remarkable absence of names of any antiquity in a country where almost every locality has its appellation is some confirmation of the traditions. The architectural character of the oldest towns also lends some support to the considerable antiquity claimed for them. The forest-covered ruins of Mexico and Central America present so many different architectural styles that it seems very probable they were built at different periods and by different peoples. Those which appear to be the oldest, and which are most uniform in style, are the substructures in Mayapan, some of the buildings in Tulha, many of those in Palenque, and others which occur in the country of the Lacandons.

The names of the successors to Votan are mentioned, but without details. One of the last of the dynasty was Chinax, in whose reign mention is made of the Nahuatl people. Not long after his death, this people, who were called Nahoas or Toltecs, obtained the dominion of the country, and the throne was occupied by Nahoas princes. They originally came from Huehue-Tlapallan (but where this country was situated is not known), having been induced to leave it in consequence of a revolution. This event seems to have occurred shortly before the Christian era. The journey to America from their native country was a long and painful one, and indicates that seas and lands intervened between them. The traditions report it to be in the far east, and that the

first comers filled seven ships and disembarked at Tampico, near the mouth of the Panuco. The leader of the band bore the title of Quetzalcohuatl, and was the first known by that name. They then coasted along the shore as far as Tamoanclia, which place was evidently somewhere near the mouth of the Tabasco. In this district there was a tradition in the time of the Spaniards that twenty illustrious chiefs from the east landed there many centuries before, who had long flowing garments and large beards, of whom the principal was Cuculcan, a name which has the same meaning as Quetzalcohuatl. Quetzalcohuatl and his comrades soon obtained possession of the capital of the country, Xibalba, which is believed to be the same as Palenque. Their success induced others of the Nahoa nation to join the first colonists, and their power gradually spread over a large portion of Central America. The strangers, however, met with considerable resistance from the princes of Xibalba, who compelled the Nahoa to leave their country and disperse themselves over the surrounding region. This dispersion is stated to have occurred in A.D. 174. Before this date the lunar calendar, so prevalent among the civilized nations of America, was introduced. It was one of these parties of Nahoa that established itself in Mexico, and founded many of the more important cities. They were called Olmeques, and were led by Olmecatl and Xelhua. The latter was one of Quetzalcohuatl's companions, and was once shipwrecked along with him. In order to commemorate his delivery he erected the great pyramid of Cholullan. Before the arrival of the Olmeques the valley of Mexico was inhabited by the Quinaemes or giants, and they continued to dwell in the mountains around for centuries after they had been driven from their native valley. The Totonacs, Mixtecas, and Othomis were the contemporaries, or possibly the predecessors, of the Olmeques. The first mentioned people erected the pyramids of the Teotihuacan, or the City of the Gods, near Mexico. These tribes spoke a language quite distinct from the Nahuatl. The Totonacs placed the cradle of their race at Chicomoctoc, which was said to be far to the north; but the Othomis seem to have been in possession of the land from time immemorial. According to the traditions of the Quiches and other nations of North America, they originally came from Tulan. They allude to several places of this name. One was in the region of the setting sun and beyond the sea; and another, from which the Quiches came, was also in the direction of the setting sun and was apparently situated in California. In the descriptions given of the migrations from the more distant Tulan, which seem to have occurred at frequent intervals, each migration, consisting of a moderate number of people, the difficulties and hardships are prominently noticed. They pointedly allude to the intense cold, to the long dark night, and to the sterility of the country, which allusions seem to point to travels in Arctic regions. The travellers were reduced to such extremities as to be obliged to suck juicy woods in order to sustain life. The name Chichimecs, which means suckers of maguey, given to the invading hordes from the north may have some connection with this traditional fact. Chicomoctoc has been identified by some with the extensive ruins near the Rio Gila, in California. The history of these early nations is somewhat obscure, but it may be gathered from the preserved records that the worship of the sun and the practice of human sacrifice had nearly or wholly superseded the earlier and purer religions. Towards the end of the 7th century we first hear of the Chichimecs invading Mexico from the north. This name is a general one given to all

invading hordes from the north, and is similar to that of barbarians applied to the people who invaded the Roman empire. The first invasion was by the Chichimecs-Culhuas, headed by Mixcohuatl Mazatzm. They commenced their march, or rather progress, from Chicomoctoc about 635, and reached the valley of Mexico about 40 years after. After many years' fighting the Toltec empire was established in about 686; and from this period we enter upon more detailed and trustworthy historical ground. At first the government of the Toltecs was republican and theocratical, but it soon became monarchical, and Nauhyotzin was elected the first king. The most illustrious of his successors was Topiltzin Ceacatl Quetzalcohuatl, during whose reign the Toltec empire arrived at its most flourishing condition. According to tradition, the Toltecs were taller and of larger build than the existing Indians; were great runners, and were as white as Europeans. They carried many of the arts to a high state of perfection, such as weaving, building, jewellery, and making ornaments with the feathers of birds. There were astrologers and poets, sorcerers and philosophers and orators. They were well acquainted with the medical properties of plants, and were in the habit of recording in books their observations on diseases. Quetzalcohuatl's reign was for the most part one of prolonged peace, but this peace was disturbed by the religious party who advocated human sacrifice, a practice which he used every effort to abolish. The rebellion becoming very formidable, Quetzalcohuatl left the country with a few chosen attendants, and founded a new Toltec empire on the plain of Huitzilapan, which corresponds with the one on which La Puebla now stands. This occurred in 895. The town of La Puebla stands on the site of the old Huitzilapan, and at the time of Quetzalcohuatl's arrival it was said that the pyramids of Cholullan had existed from time immemorial, and had been built by the giants. According to this legend the country was inhabited by giants, all but seven of whom were either destroyed by a great inundation or turned into fishes. These seven took refuge in a cave, and when the waters abated, one of them, named Xelhua, went to Cholullan and built the famous pyramid to commemorate his escape. Quetzalcohuatl built a temple here, which he dedicated to the "creator of light," and around this temple sprang up Cholullan, or the "town of the exile." His disciples carried the Toltec civilization into Oaxaca. After having reigned at Cholullan about ten years, during which period his subjects enjoyed all the blessings of peace, he was attacked by enemies again. Huemac had ascended the throne which he had vacated, and being jealous of Quetzalcohuatl's power and prosperity, he suddenly resolved to march with his army against Cholullan. In order that the town might be spared the horrors of a siege, Quetzalcohuatl informed his priests of his intention to leave the place and to visit other countries. Accordingly he proceeded to the mouth of the Coatzoqualco river, then entered a boat with four companions, and nothing more was heard of him. Huemac, finding his enemy had escaped, wreaked his vengeance on Cholullan, and took up his residence there with a view to subjugating the surrounding districts. He also reestablished the practice of human sacrifice. During Huemac's absence from his kingdom of Tulan, Nauhyotl was elected king in his stead. A battle took place between the rivals, which resulted in the defeat and subsequent death of Huemac and the establishment of Nauhyotl's power. His reign lasted for fifteen years, and, as he was one of Quetzalcohuatl's disciples, he governed according to similar principles, so that the

reign was a prosperous one. His death occurred in 945. After this a series of disasters broke over the country, and these, with constant civil war, weakened the power of the empire in Anahuac. This soon became known to other nations, and led to the Chichimecs-Teotenancas leaving their homes in Texas and New Mexico to make an irruption upon the valley of Mexico. This occurred between 1041 and 1047. The internal discord continued, and the turmoil was increased by the uprising of the sect of Ixcuinames, the devotees of which practiced the most abominable rites. In the midst of this corruption another horde of barbarians, the Teo-Chichimecs, poured down from the north and took possession of the country. The Toltec power rapidly declined and the last king of the empire was Huemac Atecpanecat, who, after his dethronement, lived for some years at Chapultepec, and died there in 1070.

According to the Guatemalan traditions, four individuals of the Tutul-Xius, a nation speaking a Nahuatl language, left their country of Tulapan, to the west of Zuyna, in A. D. 174, and arrived the same year at Ghacnouitan, which seems to be the name for some place in Yucatan. In 258 another migration of Tutul-Xius occurred, the new colony being established in the province of Zyan-Caan, which is believed to be the district around Chetumal Bay. About the end of the 10th century, it is stated that a venerable personage arrived in Yucatan, called Cukulcan, who retrieved the falling fortunes of the Tutul-Xius. According to the Abbé Brasseur de Bourbourg, this personage was no other than the Ceacatl Quetzalcohuatl, whose departure from the Coatzoalcoo river has already been mentioned. After reigning here ten years, he voluntarily abdicated the throne and left the country. According to a Mexican legend he went to Tlapallan, and died there. His successor transferred the capital of the Tutul-Xius from Mayapan to Uxmal, a town which seems to have been founded some centuries before, but which first rose to importance at this period, or near the end of the 10th century. Numerous temples and public buildings were erected, the ruins of which are now so abundantly met with in Yucatan. Artificial ponds or zonotes were constructed; and the number and magnitude of these indicate a large number of towns as well as a thickly-populated country. At the present day they have all the appearance of being natural ponds, and indeed were long considered to be such, notwithstanding the repeated assertions of the Indians that they had been built by their ancestors, until chance led to the discovery that the muddy floor of one was entirely covered with flat stones, the interstices between which were stopped with a kind of clay not known in the neighborhood. The center was occupied by four artificial wells, the walls of which were formed of polished stones. Further research led to the discovery of numerous other zonotes. After the final fall of the Toltec empire there commenced the great movement of the northern tribes towards the south, a movement which continued throughout the 11th, 12th, and 13th centuries. The movement consisted of a succession of migrations, and its starting-point appears to have been in New Mexico and California, which region was evidently the seat of a semi-civilized empire. Amongst these invading tribes was one which subsequently rose to high importance. The Aztecs, or Mexicans proper, were living at Atzlan in the 11th century, a country which was surrounded by water, and where their usual occupation was as boatmen and carriers of wood. Other tribes also lived in this region, which is believed to be that of Lower California. The Aztecs

commenced their journey towards Mexico in 1090. In 1116 they reached Chicomoztoc, and in 1177 they entered Anahuac. Settlements were gradually established in the valley, towards which peoples of various nations converged from the south as well as the north. The number of Aztecs was slowly augmented by fresh arrivals; but it was not until 1325 that they were able to lay the foundations of Mexico-Tenochtitlan, and thus to inaugurate their assumption of power.

In 1464 the empire of the Tutul-Xius was overthrown. The Mexican empire had, however, acquired large proportions, and was conducted with a magnificence and splendor scarcely equalled by any other court in America, and this empire continued up to the time of the Spanish conquest.

ZOOLOGY OF THE AMERICAS.

The zoology of America is especially interesting, on account of the contrast which exists between the fauna of the north and south portions of the continent—a contrast which is especially exhibited in the case of the Mammalia. The zoological province which naturalists mark off as constituted by South America and part of Central America has been termed the neotropical region, and the area which has the nearest relationship to this is the Indian region. As regards South America, the Andes have the highest value as zoological boundaries; next to them in importance are the rivers, and then the confines of the forest region. The Quadrumana are well represented, and are especially characteristic of the forest region which principally prevails in the western half of the continent. None are known to occur on the west side of the Andes south of Guayaquil. The sub-order Platyrrhina is peculiar to South America, and so far as research has yet extended, it is not known even to have existed on any other area. On the other hand, no catarrhine or lemurine Quadrumana have yet been found in South America. Some of the lower forms of monkey appear to have some affinity with the Lemuridae, which occur in India, Africa and Madagascar. There are two families, viz., the Cebidae and Hapalidae, all members of which are strictly arboreal in habits. Some of these monkeys are the most highly developed tree-climbers known, and in many cases they rarely if ever descend to the ground; and since the monkeys of South America have never been seen to swim, it might be expected that the broad streams of the continent effectually limit the distribution of certain monkeys. The largest species is *Lagothrix Humboldtii*, so that as a whole the American monkeys are smaller than those of Asia and Africa. As they are the most powerful of arboreal Mammalia, they rule the forests, and this may in part account for the scarcity of squirrels in this region. The Cebidae have a wide range, extending from the south of Mexico to Uruguay. They include the highest forms of American monkey, and its most specialized representatives are those which have the best adaptation for life in trees, as may be exemplified by Ateles, with its long limbs and prehensile tail. This latter organ serves all the purposes of a fifth hand; the undersurface is bare and provided with tactile papillæ, so that a monkey not only holds by, but also feels with it. It is as mobile and flexible, and in its way as useful to this genus of monkey as is the trunk to the elephant. The genus includes numerous species, the estimate varying from 8 to 40, but about 10 species have been well established. Most of them occur in Brazil and the Guianas; but each species generally has circumscribed limits.

The existing mammals of North America must now be considered. We can only refer to a few of the more conspicuous species here. South America has numerous families peculiar to itself, but North America has not which are not also represented in South America. There are numerous representatives of the *Canidae* or dog family, such as the prairie, Mexican, and maned wolves, and several foxes, of which the Arctic, common American, cross, and silver foxes are of high commercial value on account of their furs. Among the cats are three or four species of lynx, which afford valuable furs. The beaver, though abundant in some places, is, like the bison, fast diminishing before the encroaching steps of the colonists. The grizzly, the black, and the polar bears are common in the more mountainous and colder regions of the continent, and are much hunted by the fur traders. Raccoons and Virginian opossums are prevalent in the southern portion of the United States. The Rocky Mountain goat reigns supreme amidst the rocks in inaccessible fastnesses of the Rocky Mountain range; while the reindeer, the elk and the wapiti give a character to the mammalian fauna of the more level districts.

The birds of America are very numerous in almost every great family. The researches of Wilson, Charles Lucien Bonaparte, Audubon, Richardson, Dekay, Blakiston, Cassin, Gundlach, Lord Lawrence, Seater, Salvin, and Baird, have beautifully illustrated the ornithology of North America; while those of Azara, Humboldt, Swainson, Waterton, Edmonstone, Darwin, Landbeck, Philippi, Cassin, &c., have thrown great light on that of South America. The North American species of birds already described amount to nearly 700; the species of South America are over 2,300; so that we may fairly estimate the ornithology of America to include upwards of 3,000 species. The fossil remains deserve particular notice. It is very probable that the footprints on the older secondary rocks of North America are those of birds. A large number of remarkable genera found in the Cretaceous rocks have recently been described by Professor Marsh and others.

The serpents of America are very numerous, and include amongst others the following genera: *Tortrix*, *Calamaria*, *Coronella*, *Xenodon*, *Heterodon*, *Lycodon*, *Coluber*, *Herpetodryas*, *Psammophis*, *Dendrophis*, *Dryophis*, *Dipsas*, *Tropidonotus*, *Homalopsis*, *Boa*, *Elaps*, *Trigonocephalus*, *Crotalus*.

The multitude of fishes in South America is extraordinary, and still more so is the marvellous variety of form which they exhibit. A large number of species have very circumscribed ranges, so that not only does each river basin have a distinct fauna, but a number of distinct faunas occupy different portions of the same river, as is well exemplified in the Amazons, Tocantins, Rio Negro, and other rivers, where most of the fishes at stations a few hundred miles apart are for the most part specifically distinct. Professor Agassiz, in his scientific journey through Brazil, collected about 2,000 species from the Amazon basin only in fishes. As in other classes, there is a remarkable difference between the faunas of North and South America, and in this class also North America has much in common with Europe and North Asia. The sturgeons abound in North America, but are absent in South America, where the corresponding group is the Goniodonts; the siluroids are abundant in both portions of the continent; the perches are numerous throughout North America, but none occur in South America, where, however, they are represented by the Chromids. The Cyprinoids are abun-

dant in North America, but absent in South America, where we have the allied group of Cyprinodonts. The Characines of South America represent the Salmonidæ of North America, each group being confined to its own portion of the continent. There are several other small families present in South America, such as the Erythrinoids, Gymnotides, and others.

DISCOVERY OF AMERICA AND EVENTS FOLLOWING.

The discovery of a continent so large that it may be said to have doubled the habitable world is an event so much the more grand and interesting that nothing parallel to it can ever occur again in the history of mankind. America had of course been known to the barbarous tribes of eastern Asia for thousands of years; but it is singular that it should have been visited by one of the most enterprising nations of Europe five centuries before the time of Columbus without awakening the attention of either statesmen or philosophers. Iceland was discovered about 860, and colonized by the Norwegians in 874. About 50, or, according to other accounts, 100 years later, the same people planted colonies in Greenland. Into the disputes respecting the situation of these colonies we have not room to enter. Sir Charles Giesecke, a good authority, states that their ruins exist near the southern point of the peninsula. It is obvious that the same adventurous spirit which enabled these northern mariners to discover the southern extremity of the country, would not permit them to stop short without visiting what is now known to be the most habitable part of it—the western coast; and the fact has been established by an inscription in *runic* characters found on a stone four miles beyond Upernavik, at the 73d parallel, intimating that “Erling the son of Sigvat, and Enride Oddsoen, had cleared that place and raised a hillock on the Friday after Rogation day.” The marking of the date is indistinct, but it is supposed by Professor Rask, the translator, to be either 1135 or 1170; and the runic characters show at any rate that it was anterior to the Reformation, when this mode of writing was prohibited. Whoever looks at the map of Greenland, and reflects on the fact that the Norwegians must have been ascending through Davis’ Straits as high as the latitude mentioned, annually, perhaps for two or three centuries, will admit that, with half the spirit of enterprise which had carried them so far, the discovery of some portion of the west coast of these straits was almost unavoidable. Now, the position and direction of this coast once known, it required no great effort to trace it southwards to Labrador and Newfoundland. We mention these particulars because Mr. Murry, one of the few who have denied the discovery of America by the Norwegians, grounded his disbelief chiefly on the hypothesis that the colonies and the navigation of that people at the period alluded to were confined to the east coast of Greenland.

In 1001 an Icelander, sailing to Greenland, was driven away by a tempest far to the southwest, where he saw a level country covered with wood. The wind abating, he turned his course homeward and on his arrival gave such a flattering account of the country he had seen as induced Lief, the son of the founder of the Greenland colony, to undertake a voyage thither. Lief and Bjorn, who sailed together, first reached a rocky island, to which they gave the name of Helluland; then a low country, thickly wooded, which they called Markland; and some days afterwards they found trees loaded with fruits on the

banks of a river. They spent the winter in the country; and one of them, who was a German, having found wild vines growing they called it Vinland. They had some intercourse and traded for furs with a people who came in leathern boats, and were called *Skrælings*, from their dwarfish size. A colony was planted, and remained for many years in the country, the situation of which is indicated by a fact casually mentioned, that the sun remained nine hours above the horizon at the shortest day. This indicates the 41st parallel of latitude; and the actual latitude of Rhode Island, the country which every collateral circumstance would lead us to fix upon as the seat of the colony, is from 41° to 42°. The *Skrælings* were of course the Esquimaux. The *vine* appears to be the fox grape (*Vitis vulpina*), which grows wild in that part of America. Only a few unimportant particulars respecting the settlement are preserved; but it was probably abandoned or destroyed, like the Greenland colonies, of which it was an offshoot. The account, though meager, is distinct and consistent. Its authenticity can scarcely be disputed; and it is almost equally obvious that the country it refers to under the name of Vinland is in the vicinity of Rhode Island. A conclusion resting on such strong grounds scarcely requires to be supported by the high authority of Humboldt and Malte-Brun. That the colony disappeared, and that the discoveries made were not prosecuted further, are not circumstances which will shake the credit of the narrative in the minds of those who know the numerous reverses which befell the early colonies in New England and other parts of America. The hostilities of the *Skrælings* was no doubt the principal cause of the abandonment of the colony. The Norsemen describe Vinland as a rich country, with a delightful climate. Helluland, Markland and Vinland, were no doubt regarded as countries either connected with or similar to Greenland, the flattering descriptions of which, given by the first discoverers, were sadly belied by later experience. The interest excited by the obscure accounts of these countries was probably such as the announcement of a new island eastward of Spitzbergen would produce at the present day. No reasonable doubt can exist, however, that the northeastern portions of America (considering Greenland as a distinct country) were familiarly known to the Norwegians in the eleventh century.

The obscure allusions of Aristotle, Plato, and Seneca, to a country hid in the Western Ocean, must have derived fresh importance from the discovery of the Canary Isles, Madeira, and the Azores in the early part of the fifteenth century. The love of maritime adventure was excited by these events; and among the active spirits who were attracted to nautical life by the career of distinction which was then opened up was Christopher Columbus. Our limits do not permit us to enter into details respecting this great man, an outline of whose life will be found under the proper heading. He had received a learned education, and the study of the geographical systems then in vogue impressed him with a strong conviction that a voyage to India by a course directly westward was quite practicable with the degree of nautical science which his contemporaries possessed. From the old and imperfect maps of Ptolemy he was led to believe that the parts of the globe known to the ancients embraced 15 hours, or 225 degrees of longitude, which exceeds the truth by more than one-third. The discovery of the Azores on the west side had lengthened the space by one hour; and the accounts gleaned by Marco Polo in Asia induced him to think that the

to the eastward that their distance from Europe could not be great. Columbus was, however, without the fortune necessary to fit out ships; and when he attempted to interest some of the princes of those times in his project, he encountered neglects and difficulties which would have exhausted the patience of any mind less ardent than his own. At length, after many delays and discouragements, Ferdinand and Isabella of Spain supplied him with three small vessels, two of them only half-decked; and in this little armament, accompanied by 120 men, he set sail from the port of Palos on the 3d of August 1492. He proceeded first to the Canary Isles, where he was detained three weeks in repairing one of his vessels. On leaving these isles he entered on a region of ocean where all was mystery. The trade-wind, however, bore him steadily along, and the labor of the ships proceeded cheerfully, till the increasing length of the voyage, the failure of prognostics which had from time to time kept alive the hopes of the crew, and various circumstances interpreted by their superstition as evil omens, produced a mutinous spirit, which all the address and authority of Columbus would not have been able to quell had the discovery of land happened one day later than it did. Columbus, says Humboldt, on sailing westward of the meridian of the Azores, through an unexplored sea, sought the east of Asia by the western route, not as an adventurer, but according to a preconceived and steadfastly pursued plan. He had on board the sea-chart which the Florentine astronomer Toscanelli had sent him in 1477. If he had followed the chart, he would have held a more northern course, along a parallel of latitude from Lisbon. Instead of this, in the hope of reaching Zipangu (Japan), he sailed for half the distance in the latitude of Gomera, one of the Canary Islands. Uneasy at not having discovered Zipangu, which, according to his reckoning, he should have met with 216 nautical miles more to the east, he after a long debate yielded to the opinion of Martin Alonso Pinzon, and steered to the southwest. The effect of this change in his course curiously exemplifies the influence of small and apparently trivial events on the world's history. If Columbus, resisting the counsel of Pinzon, had kept his original route, he would have entered the warm current of the Gulf Stream, have reached Florida, and thence perhaps been carried to Cape Hatteras and Virginia. The result would probably have been to give the present United States a Roman Catholic Spanish population, instead of a Protestant English one, a circumstance of immeasurable importance. Pinzon was guided in forming his opinion by a flight of parrots towards the southwest. Never, says the Prussian philosopher, had the flight of birds more important consequences. It may be said to have determined the first settlements on the new continent, and its distribution between the Latin and Germanic races. It was on the 12th of October that the western world revealed itself to the wondering eyes of Columbus and his companions. What a triumph for this extraordinary man, who had treasured in his breast for twenty years, amidst neglect, discouragement, and ridicule, the grand truth which his own incomparable skill, wisdom, and firmness had now demonstrated in the eyes of an incredulous world! The spot which he first touched was Guanahani, or Watling Island, as was suggested by Muñoz in 1793, and proved by Mr. R. H. Major in 1870. After spending nearly three months in visiting Cuba, Hispaniola, and other isles, he returned to Spain. He made three other voyages, and in the second coasted along a part of South America, which he rightly judged to be a continent from the volume

of water poured into the sea by the Orinoco. But he died ignorant of the real extent and grandeur of his discoveries, still believing that the countries he had made known to Europe belonged to that part of Eastern Asia which the ancients called India. Hence the name West Indies which the tropical islands and part of the continent have ever since received.

We should extend this article to an unreasonable length were we to describe in detail the discoveries and settlements made by the several nations of Europe in America. We shall therefore confine ourselves to a very brief chronological notice of the more important events.

1492. Columbus first discovered land.

1495. The first place in which the Spaniards established their power was the large island of Hayti or Hispaniola, which was inhabited by a numerous race of Indians of a mild and gentle character, a third part of whom are said to have perished within two or three years after the Spaniards conquered them.

1497. John Cabot discovered Newfoundland June 24th, and coasted along the shore of North America to Florida.

1500. Cabral, a Portuguese, visited the coast of Brazil, and discovered the mouth of the Amazon. It was probably colonised before 1515. In 1500, too, Cortereal touched at Labrador.

1508. Vincent Pinzon is said to have entered the Rio de la Plata. It was in the same year that the Spaniards, finding the aborigines too weak for the labor of the mines in Hayti, first imported negroes from Guinea, and thus laid the foundation of a traffic which continued to disgrace the civilization of Europe for three centuries.

1511. Diego Columbus conquered the island of Cuba with 300 soldiers, of whom he did not lose one.

1513. Balboa crossed the Isthmus of Darien with 290 men, and discovered the Pacific Ocean.

1519. Hernando Cortes sailed from Cuba with 11 ships and 550 men, and landed on the coast of Mexico, which had been discovered the previous year. The conquest of the empire was finished 1521 by 950 Spaniards, assisted by a vast number of the Indians of Tlascala.

1531. Peru invaded by Pizarro, and conquered in little more than one year, with a force of 1,000 men.

1535. Jacques Cartier, a Frenchman, discovers the Gulf of St. Lawrence.

1535. Mendoza, a Spaniard, with 2,000 followers, founds Buenos Ayres, and conquers all the country as far as Potosi, at which silver mines were discovered nine years after.

1537. Cortes discovers California.

1541. Chili conquered; Santiago founded; Orellana sails for the sources of the Rio Napa down the Amazon to the Atlantic.

1578. New Albion on the northwest coast of America, discovered by Sir Francis Drake.

1586. The Spaniards found St. Thomas' Island, in Guiana.

1587. Davis' Straits and Cumberland Islands discovered by John Davis.

1604. De Monts, a Frenchman, founded the first settlement in Nova Scotia, then called Acadie.

1607. After many ineffectual attempts during more than twenty years, the first permanent settlement of the English in North America was made this year, on the banks of the James River, in Virginia.

1608. Quebec founded by the French, who had had a small neglected colony in Canada from 1542.

1611. Newfoundland colonised by the English; a Dutch colony established at Hudson's River.

1614. New York founded.

1618. Baffin penetrates to the 78th degree of latitude, in the bay which bears his name.

1620. The first English colony established in New England at Plymouth. It was in this year that the first negroes were imported into Virginia. They were brought by a Dutch vessel.

1635. A French colony established in Guiana.

1655. Jamaica conquered by the English,

1664. The Dutch colonies on Hudson's River capitulate to the English.

1666. The Buccaneers begin their depredations on Spanish colonies.

1682. William Penn establishes a colony in Pennsylvania. La Salle takes possession of Louisiana in the name of the French king.

1698. A colony of 1,200 Scots planted at Darien. In the following year the settlement was attacked by the Spaniards, and abandoned.

1733. Georgia colonised by the English.

1760. Canada and all the other French settlements in North America conquered by the English.

We must pause at this point to give a very short account of the colonial system introduced by the principal European nations who occupied extensive tracts of the New World. The English settlements extended from the 31st to the 50th degree on the east coast, and were divided into 15 or 16 provinces. The colonists had carried the love of liberty characteristic of their countrymen with them; and after many struggles with their British rulers, all the provinces, with one or two exceptions, were permitted to enjoy a form of government extremely popular. The executive power was vested in a governor appointed by the king. He was assisted by a council, which sometimes conjoined the functions of a Privy Council and a House of Peers. The people were represented by a House of Assembly, consisting of persons chosen by the freeholders in the country parts, and the householders or corporations of towns. The governor could levy no money without the consent of the House of Assembly. The British parliament, however, claimed, but scarcely ever exercised, the privilege of imposing taxes upon the colonists without consulting them. Against this assumption of power the local legislatures always protested as an infringement of their rights. The vessels of foreign states were not permitted to trade with the colonies; but the colonists were allowed to trade in their own ships with one another, with the mother country, and, to a limited extent with foreign states. Their taxes, which were always small, were all consumed in defraying internal expenses; and, compared with any other people in the new world, they enjoyed an unexampled degree of commercial and political liberty. It was the growing prosperity of the colonies and the increasing debt of the mother country which induced the British ministers, for the first time, in 1764, to attempt raising a revenue in America, for purposes not colonial. The experiment was made by imposing a stamp-duty on newspapers and commercial writings. The sum was trifling; but the Americans, far-sighted and jealous of their rights, saw in it the introduction of a principle which deprived them of all security for their property. The people declared themselves against it as one man, in local assemblies, and by petitions and publications of all kinds. The ministers became uneasy, and repealed the tax; but, as a salve to the pride of the mother country, a declaratory Act was passed, asserting her right "to bind the colonies in all cases whatsoever." The idea of raising a revenue in America was not renounced, but another

mode was to be tried. Duties were laid on glass, colors, paper, and tea, and were met by an opposition in the colonies still more zealous and determined. The British ministers, irritated, but wavering in their purpose, dropped all the taxes but that on tea, and commenced at the same time a series of alarming innovations. They closed the port of Boston, changed the charter of the province, placed judges and juries on a footing to render them more subservient to the views of the government, and introduced a strong military force to everawe the people. On the other side, the colonists passed resolutions not to import or consume any British goods, and hastened to supply themselves with powder and arms. Blood was at length shed in April 1775, at the village of Lexington; and in the following year the American Congress published their celebrated declaration of independence. We shall not enter into the details of the war, which was closed in 1782. Suffice it to say that, on the part of the Americans, it rested on high grounds; it was a war to vindicate a principle—for the practical grievance was admitted to be slight; and it was conducted with a regard to humanity of which there are few examples in history.

The Spanish possessions in America before the revolution formed nine distinct governments, all constructed on the same plan and independent of one another. Four of these, of the first rank, were viceroyalties, viz., Mexico, Peru, La Plata, and New Granada; and five were captain-generalships, viz., Yucatan, Guatemala, Chili, Venezuela, and the island of Cuba. The government was vested in the viceroy or captain-general, who was held to represent the king, and to enjoy all his prerogatives within the colony. But in these countries, as in others where the supreme power is apparently unlimited, it was indirectly restrained by the influence of the courts of justice, corporations and other public bodies. The royal audiences or supreme courts, composed of Spaniards nominated by the crown, had extensive judicial powers, and were independent of the viceroys. The *cabildos* or municipalities, and the *fueros* or corporations (similar to our guilds), also possessed considerable privileges, which derived security and importance from long prescription. Lastly, the clergy, who were numerous and rich, necessarily possessed great influence among a superstitious people. The vices naturally inherent in the colonial system existed in full force in the Spanish American dominions. There was tolerable security for all classes except the miserable Indians, who were regarded and treated precisely as beasts of burden, out of whose toil and sufferings a provision as ample as possible was to be extracted, first to supply the wants of the royal treasury, and next to provide for and satisfy the cupidity of a shoal of do-nothing public officers and priests. Edicts were indeed issued for the protection of the Indians, and persons appointed to enforce them; but these were feeble correctives of the evils rooted in the system, and not unfrequently increased their weight. The Indians, after the conquest, were at first slaves; they paid a capitation tax to the crown, and their labor was entirely at the disposal of their lord. This system was modified from time to time; but all the changes introduced down to the revolution did not release them from their state of vassalage. They still continued liable, in a less or greater degree, to the performance of compulsory labor, under the orders of persons against whom they had no protection. This was an enormous grievance; but, what was equally bad, being held incompetent in law to buy or sell, or enter

into any pecuniary engagement beyond the value of a few shillings, without the agency of white men, the swarm of public functionaries had an unlimited power of interfering in their concerns, of vexing, harassing, and plundering them, under the forms of law. The memoir of Ulloa, long buried amidst the Spanish archives, with various other documents published since the revolution, depicts acts of extortion, perfidy, cruelty, and oppression practiced upon the Indians which have rarely been paralleled. Men rose to affluence in offices without salaries; and the priests rivaled the laymen in the art of extracting money from those whom they ought to have protected. As the sole aim of the Spaniards in the colonies was to enrich themselves, so the government at home made all its acts and regulations subordinate to the grand object of raising a revenue. Spain retained in her hands the whole trade of the colonies, and guarded her monopoly with the most severe penalties. The price of all European commodities was enhanced three, four, or six fold, in America. The colonists were not allowed to manufacture or raise any article which the mother country could supply; they were compelled to root up their vines and olives; and for a long period one colony was not even permitted to send a ship to another. To support such a system it was necessary to keep the people in profound ignorance, and to cherish prejudices and superstition. The schools were extremely few, and permission to establish them was often refused, even in towns where the Spaniards and Creoles were numerous. The importation of books, except books of Catholic devotion, was rigorously prohibited. Even the more grave and dry sciences, such as botany, chemistry, and geometry, were objects of suspicion. And the more effectually to crush all mental activity, natives of America could rarely obtain leave to go abroad, to seek in foreign countries what was denied them in their own. On the other hand, the priests, sharing in the spoil, filled the minds of the people with childish superstitions, as a means of confirming their own power, and employed the terrors of religion to teach them patience under oppression. To create a race of servants devoted to its purposes, the court bestowed all offices, from the highest to the lowest, on natives of the peninsula exclusively. The wisdom of the plan seems questionable, but that it was adhered to with wonderful pertinacity is certain. "It was the darling policy of Spain," said Mr. Ward, "to disseminate through her American dominions a class of men distinct from the people in feelings, habits, and interests, taught to consider themselves as a privileged *caste*, and to regard their own existence as intimately connected with that of the system of which they were the principal support." With all those means and appliances, it is extraordinary that Spain should have been able to uphold for three centuries a system in which the interests of so many millions of human beings were so habitually and unrelentingly sacrificed. It was the course of events, much more than its own inherent weakness, which ultimately caused its subversion.

After the seizure of Ferdinand and the elevation of Joseph Buonaparte to the throne of Spain, orders were dispatched to all the colonies with the view to securing their obedience to the new dynasty. The men in office were generally disposed to submit, but the treacherous conduct of the French excited a universal hatred of their cause among the people; and when the regency established in Spain presented the semblance of a patriot government, the loyalty of the Americans blazed forth, and poured large contribu-

tions of money into the hands of Ferdinand's adherents. The weak and suspicious conduct of the regency, however, and its subservieney to the grasping spirit of the merchants of Cadiz, at length alienated the colonists, and roused them to take measures for their own security. But the diversity of views and interests among the colonists rendered the course to be adopted a matter of some delicacy. Ferdinand, being a prisoner, was, politically speaking, a non-entity. Napoleon's brother was clearly an usurper, odious to, and rejected by, the mass of the Spanish people. The regency, shut up in Cadiz, without troops or revenue, was but a phantom; and the little power it had was so employed as to raise doubts whether its members were not secretly in league with the enemy. In these circumstances, when the only government to which the colonists owed allegiance had fallen into abeyance, the wisest course they could have pursued was to declare themselves independent. This would at once put a stop to the machinations of France, which they dreaded, and prevent the regency from compromising or sacrificing their interests by its weakness or treachery. The Spaniards, however, who occupied all public situations, were averse to a change which they foresaw must lead to the downfall of their power. This was perfectly understood by the other classes; and in the first movements which took place in the different colonies nothing was said derogatory to the supremacy of Spain, though independence was clearly aimed at. By spontaneous efforts of the people "juntas of government" were formed at Caracas in April, 1809, at La Paz in Upper Peru in July, at Quito in August, at Santa Fé and at Buenos Ayres in May 1810, and at Santiago in Chili in September the same year. In 1810, also, the first insurrection broke out in Mexico. The colonists unluckily had been too long the slaves of superstition and tyranny to be fit for so bold an experiment; and after a struggle, which was generally short, but almost everywhere bloody, the juntas were all put down except in Colombia and Buenos Ayres. But in the stir and tumult of the contest old prejudices had received a shock, and the seeds of political change had struck their roots too deep in the soil to be eradicated. A desultory war was carried on for six years between Buenos Ayres and Upper Peru, with little advantage on either side. At length, in 1817, the former state, which had assumed the style of an independent republic four years before, sent an army across the Andes to Chili, under General San Martin, and defeated the Spaniards at Chacabuco. A second victory, gained at Maipo, in April, 1818, led to the entire subversion of the Spanish power in this colony. The war was now transferred to Peru, where the Spaniards continued to lose ground, till the decisive battle of Ayacucho put an end to their power in December, 1824. Rodil and Olaveta, with the obstinacy of their nation, held out for some months longer, when every chance of success was gone; but after the surrender of Callao, in January, 1826, the Spanish flag no longer waved on any spot in the land of the Incas.

In New Granada and Venezuela the struggle was more bloody, variable, and protracted than in any other part of South America. As this portion of the dominions of Spain was comparatively easy of access, and from its central position was in some measure the key to the whole, she made immense efforts for its preservation. No less than ten thousand troops were sent out to it within the course of one year. The patriots, on the other hand, possessed advantages here, in the greater intelligence of the population and the easy

intercourse with the West Indies. From 1809, when juntas were established in Caracas and Quito, to the surrender of Porto Cabello in 1823, the vicissitudes of the war were numerous and extraordinary. The patriots were repeatedly on the eve of a complete triumph, and as often the state of their affairs seemed nearly hopeless. But the spirit of resistance never was entirely subdued. The cause was rooted in the hearts of the people, and was insensibly gaining ground, even during its reverses. To attempt the faintest outline of the military operations would lead us beyond our proper limits. It is enough to state that the decisive victory of Carabobo, gained by the patriots in 1819, gave them an ascendancy which they never afterwards lost; but the Spaniards, according to their custom, continued to maintain the contest as long as they had a foot of land in the country, and were only finally expelled in 1823.

In Mexico the revolutionary movement began at Dolores, in 1810, and soon wore a very prosperous appearance; but the weakness or false pride of the Creoles, who were cajoled into the ranks of their oppressors, the old Spaniards, armed against the patriots those who should have been their firmest supporters, and by one or two mischances, the force of the independent party was ruined in November, 1815, when Morelos, their able leader, was taken prisoner and executed. For six years after this period many guerrilla bands maintained themselves in the provinces, and greatly annoyed the Spaniards; but they did not act in concert, and no congress or junta professing to represent the Mexican people existed. Even during this interval the desire for independence was making great progress among the population; but the establishment of a constitutional government in Spain in 1820, and its extension to the colonies, gave a new aspect to the affairs of Mexico. The viceroy Apodaca, while outwardly yielding obedience to the new system, was silently taking measures to effect its overthrow; but he mistook the character of the agent he employed. This person, the celebrated Iturbide, turned his own arms against him, proclaimed a constitution under the name of "the three guarantees," and put an end to the dominion of Spain in 1821, almost without bloodshed. Iturbide, who had nothing in view but his own aggrandizement, called a congress, which he soon dissolved after getting himself proclaimed emperor. His usurpation kindled a spirit of resistance. He was exiled in 1823, made a new attempt on the liberties of his country in 1824, was taken prisoner, and expiated his crimes by a military death within a few weeks after he landed.

Guatemala was the last portion of the American continent which threw off the Spanish yoke. In 1821 the persons in office assembled and formed a junta. Divisions arose, which were fomented by the intrusion of a Mexican army sent by Iturbide. This force, however, was beaten, and an elective assembly called, which declared the country independent, and established a constitution in July, 1823. Spain now retains none of her possessions in the new world but Cuba and Porto Rico.

The government of Brazil was conducted by the Portuguese on a system extremely similar to that of the Spanish colonies. The monopoly which the mother country retained of the commerce of the colony was equally rigorous; the restrictions on its internal industry as severe, and the same means were employed to keep the people in a state of pupillage and ignorance. Down to 1806 a single printing-press had never existed in Brazil. In 1807, when the Emperor Napoleon had resolved to possess himself of

Portugal, and if possible to get the royal family into his power, the king, seeing no other means of escaping from the clutches of his enemy, embarked with his suite in several ships, and sailed for Brazil, where he arrived in January, 1808. He was received with joy by the colonists, who anticipated great benefits from his residence, of which they were not disappointed. One by one the fetters of colonial dependence fell off. Within a few months printing-presses and newspapers were established, the ports were opened to the trade of all nations, and the people were invited and encouraged to prosecute all those branches of internal industry from which they had till now been interdicted. To crown and secure these advantages, Brazil was declared an independent kingdom in 1815, subject to the crown of Portugal, but entitled to its separate administration and its own laws. The revolutionary spirit pervading the Spanish colonies now found its way into Brazil, and produced an insurrection at Pernambuco in 1817. It was soon subdued, but received a new impulse from the constitutional systems suddenly introduced into Spain and Portugal in 1820.

To quiet the popular feeling, it was announced that the Portuguese constitution would be extended to Brazil. Before this had been done, however, the old king had sailed for Europe, leaving his son Dom Pedro to rule in his absence. The people now discovered, or believed, that the object of the king was to degrade Brazil again to the rank of a colony, and to restore the old system in all its rigor. Meetings were held, and resolutions adopted to maintain the independence of the country at all hazards; and the patriots, gaining confidence by degrees, called loudly for the establishment of a legislature, and besought Dom Pedro to put himself at the head of the independent government. Ambition or policy induced Pedro to listen to the solicitation; in 1822 he was proclaimed emperor, and had his own title and the independence of Brazil acknowledged by his father three years afterwards. A representative system was at the same time introduced. An unlucky war now arose with Buenos Ayres, which weakened both countries; but it was at length terminated in 1828 by the recognition of the disputed territory as an independent state under the title of Banda Oriental.

NORTH AMERICA; PHYSICAL FEATURES, ETC.

The mountain ranges of North America form two widely distant highland regions, separated from each other by the vast interior plain, which contains, in its southern slope, the Mississippi with all its tributaries, and the other rivers flowing into the Gulf of Mexico, while its northern part contains the great fresh-water lakes and many rivers taking a northward course to Hudson's Bay or to the Arctic seas. The watershed of this plain, dividing the streams that run into the Missouri and Mississippi from those communicating with the Saskatchewan, with Lake Winnipeg, and with Lake Superior, is along a line from west to east nearly coinciding with the 48th parallel of latitude, and has a mean elevation of 1,500 feet.

Along the whole of the western side, from near the mouth of the Mackenzie in the Arctic Ocean, and from Alaska on the Pacific shore, to the Isthmus of Nicaragua and Panama, that is, across 60° of latitude from north to south, extends with a grand double curve the continuous length of the Rocky Mountains, and others which prolong the line, having a position in North America similar to that of the Andes in South America, and shutting off, in some parts, a com-

paratively narrow portion of the continent, with the Pacific shore, from the great central plain. But several minor ranges, branching off or confronting the principal mountain-ridge or backbone of North America, enclose large spaces of a table-land, traversed by the Columbia, the Fraser, and the Colorado rivers, with those which join them, and holding the Great Salt Lake of Utah in its central basin. The Cascade Mountains of Washington and Oregon, the Sierra Nevada of California, and the Coast Range prolonged through the Californian peninsula, have a general direction from north to south; while the Wahsatch, the Humboldt, the Blue Mountains, the Salmon River, and other ranges, stand rather across the table-land, or obliquely, from west to east. It may be convenient to speak of the former series, regarded collectively, as the general Pacific Coast Range, which we also observe to be continued northward, with some intervals, beyond latitude 60° N. to the peninsula of Alaska, presenting summits of increased height, that of Mount St. Elias being about 17,000 feet, and Mount Fairweather nearly 15,000 feet. In the Cascade Range are Mount St. Helen's, north of the Columbia River, attaining an elevation of 15,750 feet; Mount Hood and Mount Jefferson, about 15,000 feet. The Sierra Nevada, at its northern extremity, where it forms an acute angle with the coast range, displays the lofty terminal peak of Mount Shasta, having an altitude of 14,400 feet. The minor Californian Coast Range nowhere rises to 4,000 feet. The main Cordillera or spine of Western North America, which in the British Dominion and in the United States' territory is called the Rocky Mountains, but which takes the name of the Sierra Madre in Mexico, and in the isthmus, farther south, is split into two lower groups of a volcanic character, attains the height of 16,000 feet in Mount Brown, and 15,700 feet in Mount Hooker, both near the 54th degree of latitude, above the source of the Saskatchewan river; but Fremont, in the Wind River group, between Oregon and Nebraska, is 13,560 feet high, and there are peaks of 10,000 feet or 12,000 feet in Utah and New Mexico. The highest mountains, however, in North America, excelling even Mount St. Elias, belong to a volcanic series which crosses the table-land of southern Mexico from west to east, and of which the culminating points are Popocatepetl, 17,884 feet, and Orizaba, 18,210 feet; while Agua, in Guatemala, rises to 13,000 feet. Thus we may remark, at each extremity of the Cordillera, at its north end, towards Alaska, and at its south end, in Central America, it is encountered by a cluster of volcanoes, Mount St. Elias being one of this description, which exceed the height of the Rocky Mountains. The spaces enclosed between the main trunk and branches of this immense system of mountains are several hundred miles wide, and the surface is elevated 5,000 feet or 6,000 feet above the sea-level, as in the Utah lake-basin, the Nevada territory, and the plateau of Anahuac, or southern Mexico, which last has an elevation of 6,000 feet to 8,000 feet, and has therefore a temperate climate within the tropics.

An outline merely has been given of the western highland region of North America. The eastern highlands of this continent are mainly constituted by the Alleghanies or Appalachian system of mountains, with their dependencies, which are of no great height, the Black Mountain, or Mount Guyot, in North Carolina, being the highest, at 6,476 feet; but they extend nearly 2,000 miles, from the Gulf of St. Lawrence to the Gulf of Mexico, having a general direction from northeast to southwest. The strip of land, one or two hundred miles wide, between these mount-

ains and the Atlantic coast, is of the greatest historical interest, as it includes the seats of all the older English settlements on this continent, which seems destined for the grandest dwelling-place of our nation. North of the Gulf of St. Lawrence, through the peninsula that terminates with Labrador between the Atlantic and Hudson's Bay, the Appalachian system of mountains is continued, or resumed, in a range called the Watchish, only 1,500 feet high, but in the severe climate of that region covered with perpetual snow. The Alleghanies, south of the St. Lawrence, including the Green Mountains of Vermont and the White Mountains of New Hampshire, are not so much a chain of mountains as a long plateau, crested by several different ridges, and intersected by wide valleys of considerable elevation, but altogether on a much smaller scale than the highlands of Western America. East of the river Hudson the mountains are chiefly granitic, with rounded summits, often covered with turf or moss to the top; they assume a more regular formation in Pennsylvania, Virginia, and North Carolina, but again decline and break into detached groups in approaching their southern extremity in Alabama. Next to the summit in North Carolina, which is named above, Mount Washington in New Hampshire stands pre-eminent, with an altitude of 6,428 feet. The scenery of these "White Mountains" is very striking, especially where the Saco river cleaves its way through the barrier of granite by a cutting two miles long, in one place only 22 feet wide, between lofty precipitous walls. It is in the "Green Mountains," succeeding these to the west, and giving their name in French to the neighboring State, that the prevalent form becomes that of round humps on a broad base, with firs or shrubs growing on the slopes, and with scanty grass or lichens on the summits. Both these two contrasted groups of New England mountains enter the State of Massachusetts from the north; the Hoosac and Taconic extensions of the Green Mountains rise on the west side, while the White Mountains are continued by those of which Mount Holyoke and Wachusett are the most conspicuous; and between their parallel ranges is the Connecticut river, with the Housatonic, Mount Tom, and Blue Hills to overlook its lower course. These features of the country, though of far less physical importance than the towering peaks of Colorado and California, will always be associated with the genuine traditions of English rural, domestic, and social life, transplanted to the New World in the 17th century, and defended by a long struggle against stern nature and savage men in the early age of the American colonies. The natural boundary separating New England from the great and more modern State of New York is that noble river the Hudson, rising in the Adirondack Mountains near Lake Champlain and the waters of the St. Lawrence, but pouring its beautiful and useful stream directly south, to the greatest of American commercial ports and cities. This river passes close by the Catskill and Shawankunk Mountains, from which is continued the general distribution of the eastern American highlands along the Atlantic states, but with a more westerly declination from the coast, running through Pennsylvania, West Virginia, the borders of Tennessee, and North Carolina, the upper parts of Georgia and Alabama. It is in Virginia that the Alleghanies have their greatest breadth, which is about 150 miles. They rise higher in North Carolina and Tennessee, and subsequently keep up a distinct line of position, across the cotton-growing States, between those of the Atlantic seaboard and those of the Lower Mississippi. This circumstance,

it may be remarked, has had most important effects on the political and military events of late years, in the results of the attempted secession of the slave-holding States from the Union. Another feature of physical geography, which probably conditioned the earlier stages of that momentous civil struggle, in the disputes relating to the Missouri compromise and to the admission of Kansas as a free-soil State, is the existence of the Ozark range of mountains. These stand in the middle of the great Mississippi valley, stretching across from northern Texas to Arkansas and the confluence of the Missouri with the Mississippi. By the elevation they give to the soil, in latitudes between 30° and 40°, as well as by the raised tableland of New Mexico and Arizona farther west, the area of the United States' territory suitable for cotton plantations and for slave labor was so far limited, and confined to the shores of the Gulf of Mexico and the Atlantic seaboard. At the same time, in the latitudes north of these, between 40° and 50°, the whole vast prairie region, from the Ohio to the Rocky Mountains, was adapted to the growth of corn, while it had such continuity and uniformity of surface, and was so pervaded by the grand river-system of this middle plain of North America, that it could not undergo political division. The entire West being thus secured to the Union, and the better part of the South being thus rescued from the curse of Negro slavery, by the moulding hand of nature in planning the distribution of mountain ranges and the level ground all over this continent, we may consider that the political and social destinies of the great American Republic, vindicated in the civil war from 1861 to 1865, were predetermined in the formation of the land.

The North American continent affords an interesting study of the geological changes and adjustments, by which the mighty work of preparation for what promises to be a noble development of humanity was slowly effected in the remote epochs of the past. The oldest sedimentary rocks anywhere found on the globe are those which underlie the whole of Canada, New Brunswick, and Newfoundland, the Labrador peninsula, and the country north of Lake Superior, perhaps also the less explored regions of the northwest towards the Arctic Sea. This series, named the Laurentian from the St. Lawrence river, is perceived to exist in Europe only in a few scattered instances, in the Hebrides, and in Norway or Sweden. In North America it occupies the most extensive areas; the thickness of its beds is estimated by Sir William Logan at 30,000 feet; it rises to hills or mountains 4,000 feet high, and in the deep gorge of the Saguenay river, forms perpendicular cliffs of 1,500 feet. Only one fossil animal, which has been called the *Eozoön Canadense*, has been discovered to have left its trace in this most ancient bottom of the primeval ocean; it was one of the Foraminifera, which covered its gelatinous body with a thin crust of carbonate of lime, having numerous holes or pores for the emission of its filament-members, with which to feel and feed outside. Next to the Laurentian, but with a vast unknown interval of time, comes the Huronian or Lower Cambrian series. It is suggested by geologists that, as the vast level bed of the Laurentian sea was cracked by internal changes of the earth's density, these cracks threw up certain ridges along the surface of the present continent, which laid a foundation for the principal mountain ranges we have described. At the borders and extremities of these mountain ranges, it is evident that there were intense volcanic eruptions, producing great quantities of lava and conglomerate, basalt, greenstone, and other forma-

tions resulting from igneous action. The northern shores of Lakes Huron and Superior exhibit results of this kind; but it is in the table-land between the Rocky Mountains and the west coast ranges, as in the singular lava beds near the Klamath, on the frontier of Oregon and North California, that volcanic forces have made their strongest marks on the earth. On the eastern side also of the grand Cordillera, between the sources of the Missouri and of the Yellowstone rivers, is a wonderful region of boiling springs or geysers, of sulphur beds and other natural curiosities, which have been ably described by Dr. Hayden, of the United States' Government Survey. To speak more generally of the local arrangement of the different geological formations, it may be remarked that crystalline rocks are spread over the western parts of North America, from Alaska to Nicaragua, and over the most northern parts, also including Greenland; but some of later date are found in the eastern Appalachian range, consisting of felspathic gneiss and quartz rocks, mingled with talcose and chloritic schists. The Palæozoic formations occupy that middle part of the continent which lies between the Rocky Mountains and the great lakes, as well as the shores of Hudson's Bay and some portions of the Atlantic coasts. With reference to the Lower Silurian or Siluro-Cambrian period, it is abundantly illustrated by the Trenton and associated limestones, which can be traced over 40° of longitude, their beds consisting entirely of *débris* of coral, shells and crinoids, from the shallow inland sea, teeming with animal life, that once filled the whole level space between the Alleghanies and the Rocky Mountains, separated by these ridges from the Atlantic and Pacific Oceans, and sheltered from the cold Arctic currents by the northern Laurentian highlands. This space, which is now the central plain of North America, comprising the prairies and the Mississippi valley, was then a coral sea with archipelagos of volcanic isles, resembling that of Australasia in the South Pacific. The next formation succeeding the Silurian presents immense deposits of sandstone and shale from the muddy waters troubled by subterranean motions; this is the Devonian formation, which in America has been called the Erian on account of the great development of such beds south of Lake Erie. The deposits of this period in the western continent are stated to be 15,000 feet in thickness. They include the cliff limestones, studded with calcareous corals of great size and beauty of shape, noticed by Sir Charles Lyell at the falls of the Ohio, near Louisville; there limestones are estimated to extend, as an ancient coral reef, over 500,000 square miles of the American middle plain. In the State of New York and in Western Canada there is the coniferous limestone, in which the imbedded corals have been replaced, in the cavities they once filled, by flinty hornstones which present the perfect coral forms, as though cast in a mould. In the Carboniferous age the great internal sea of the continent was slowly changed into swampy flats and shallow lakes or creeks, and gradually filled with a rank vegetable growth, afterwards buried under later marine deposits and pressed into the existing coral-beds. Of this period there are very extensive developments throughout the eastern half of the great middle plain to the Alleghanies. This portion of America seems to have been land, covered with the forests of that period, while the western half of the middle plain, a northward extension of the Gulf of Mexico, was still under water. As the eastern half of North America, between the Mississippi and the Atlantic, was thus in the Carboniferous era well raised out of the sea, it exhibits no

traces of the succeeding Permian age, such as we find in Europe. The earliest periods also of Mesozoic time have failed to leave any record here, but their formations appear towards the western range of mountains in what was the bed of a mediterranean sea. It is, however, the Cretaceous system, with its characteristic greensand, its sands, clays, marls, and soft grey limestones, that occupies most space in Western America, between the meridians of 97° and 112°. These strata, overlaid sometimes by those of the Tertiary periods, extend through the country up the Missouri, the Platte, the Arkansas, and the Red River, to the Rocky Mountains; they also form parts of the plains enclosed by different mountain ranges beyond the Cordillera. Along the eastern side of the Appalachians there is a broad belt of the Cretaceous formation, stretching from the Delaware across the upper parts of Virginia, Carolina, Georgia, and Alabama. Among the fossil animal remains discovered in this formation in North America, which are enumerated in a separate list, one of the most remarkable is that of the *Mosasaurus*, a combination of the serpent with the lizard form, sometimes 80 feet in length, and of aquatic habits. The Tertiary deposits, including the boulder clay, prevail chiefly along the seaward districts from Long Island, above New York, to the peninsula of Florida, and around the shores of the Mexican Gulf, and likewise on the Pacific shore from Lower California to Vancouver Island, also in some detached instances, as in Nebraska, in the midst of the interior plain. The newer Pliocene is met with in the southern part of Maine, and on the shores of Lake Champlain. The drift formation lies mostly north of 40° latitude. Alluvial deposits are of great amount from the large rivers and lakes, especially in the delta of the Mississippi, which has an area of 13,600 square miles, and must, by Sir Charles Lyell's reckoning, have taken 67,000 years for its composition, at the rate of the bringing down of solid matter by that mighty river.

The mineral products of North America are of unequalled richness and variety. Gold is abundant, to a proverb, in California, and likewise in Nevada and Montana. It is also found in British Columbia, Mexico, Central America, and Canada, and sparingly in Virginia and South Carolina. Silver is obtained from Nevada in larger quantities than from any other country; it is supplied also by California, Mexico, Honduras, and a vein of this metal is worked in Newfoundland. Great masses of almost pure copper are found in the Huronian rock strata, the north and east shores of Lake Superior being the richest of copper-mining regions; while New York State and Indiana possess a share of the same metal, and it is found among the western mountains in different countries from British Columbia to the isthmus. The iron ores of Pennsylvania, and those of Canada, including New Brunswick, are of the greatest importance; the former are rendered more available by their occurring close to the beds of bituminous coal, giving materials for the manufacturing industry of Pittsburg; while anthracite coal is obtained from the eastern districts of Pennsylvania. It is estimated that one-third of the total area of this State is occupied by coal-fields, which can scarcely be exhausted. Lead is found in Wisconsin, Illinois, and Missouri, in New York State, in Canada, in California, and in Central America, as well as quicksilver; white zinc is got from Arkansas and New Jersey; both Canada and Mexico produce tin. Reverting to the subject of coal, as having an intimate economic connection with all metallic wealth, it should be



WEST INDIA IS.

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FRANCE

Spain

Port of Spain

Trinidad I.

Guiana

French

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SOUTH AMERICA



observed that the united area of all the coal-fields in the United States is estimated at 190,000 square miles, exceeding twenty-fold those of Europe. The chief of these coal-fields are, first, the Appalachian, extending from the Susquehanna, in Pennsylvania, to the Tuscaloosa, in Alabama, along the west side of the Alleghany Mountains; the area of this coal-field is 70,000 square miles, and its greatest thickness 2500 feet; secondly, the coal-field of Michigan, about the center of that State; thirdly, the extensive coal-field between the Ohio and the Mississippi, across the States of Indiana and Illinois; lastly the Iowa and Missouri coal-field, which occupies a large space in the very center of the continent. Coal is found also in Nova Scotia, in British Columbia, and Vancouver Island, and wherever the Upper Palæozoic strata prevail in the geological structure. But in the vast extent of British American territory northwest of Lake Superior, around Lake Winnipeg and up the Saskatchewan river, even as far as the Peace river, in latitude 56° N., it may be expected that manufacturing as well as agricultural prosperity will result from the use of immense stores of natural wealth existing in the soil of that long-neglected land, which is now proved to have a climate not more severe than the inhabited provinces of Canada. The iron and copper, more especially of the Canadian Dominion, will employ and enrich, in all probability, at some future period, a nation that may become greater in material resources than the most powerful kingdoms of Europe. In view of these prospects from the working of the useful metals, by the aid of that most useful product of the earth which supplies heat and mechanical force to the service of human industry, we may regard the Californian gold-fields as a matter of secondary importance. They have indeed been surpassed by the productiveness of those in Australia and New Zealand.

Nine-tenths of North America lying under the temperate zone, the climate follows a different law from what is observed in the southern peninsula, and presents more striking contrasts with that of the best known parts of the Old World. The long narrow region now denominated Central America, which connects the two great divisions of the continent, stretching from Panama to Tehuantepec, has in general a very humid atmosphere; but, for a tropical country, it must be only moderately hot, as every part of it is within a small distance of the sea. At Vera Paz the rains fall during nine months of the year. Mexico is hot, moist, and unhealthy on the low coasts; but two-thirds of its area, comprising all the populous districts, consists of table-land, from 5,000 to 9,000 feet in height. In consequence of this singular configuration of its surface, Mexico, though chiefly within the torrid zone, enjoys a temperate and equable climate. The mean heat at the capital, which is 7,400 feet above the sea, is $62\frac{1}{2}^{\circ}$, and the difference between the warmest and coldest months, which exceeds 30° at London, is here only about 12° ; but the atmosphere is deficient in moisture, and the country suffers from drought. Beyond the parallel of 24° N. the western shores are hot and arid.

In the extensive region lying between the parallels of 30° and 50° N., which comprehends three-fourths of the useful soil of North America, we have three well-marked varieties of climate, that of the east coast, the west coast, and the basin of the Mississippi. On the east coast, from Georgia to Lower Canada, the mean temperature of the year is lower than in Europe by 9° at the latitude of 40° , and by $12\frac{1}{2}^{\circ}$ at the latitude of 50° , according to Humboldt's calculation. In

the next place, the range of the thermometer is much greater than in Europe, the summer being much hotter and the winter much colder. At Quebec the temperature of the warmest month exceeds that of the coldest by no less than $60\frac{1}{2}^{\circ}$ of Fahr.; while at Paris, which is nearly under the same latitude, the difference is only 31° . In the third place, the climate undergoes a more rapid change in America as we proceed from south to north, a degree of latitude in the middle of the temperate zone producing a decrease of annual temperature of $1^{\circ}.13$ Fahr. in Europe, and $1^{\circ}.57$ Fahr. in America. The comparison is greatly to the disadvantage of America when made in this form; but when the east coasts of the two continents are compared, the case is altered; the Old World is found to have no superiority over the New, for Pekin has still colder winters and warmer summers than Philadelphia, which is under the same latitude. It is the west coast of the new continent which ought to exhibit the climate of Europe; and from the observations made, we have reason to believe that it is quite as mild and equable. At the mouth of Columbia river, in latitude $46\frac{1}{2}^{\circ}$ N., it appears that the mean heat of the warmest month was about 62° Fahr., of the coldest about 36° , and of the whole year 51° . Now the place is under the same latitude with Quebec, where the snow lies five months, and the mean temperature during the three winter months is 18° below the freezing point.

This single circumstance marks emphatically the contrast in the climate of the east and west coasts of North America. But the mouth of Columbia river is also under the same parallel with Nantes at the mouth of the Loire; and we have, therefore, good grounds to conclude that the west coast of America, in the middle latitudes, has nearly as mild and equable a climate as the west coast of Europe. The climate of the great central valley, or basin of the Mississippi, has a considerable affinity to that of the east coast. It was long a matter of dispute in what the difference between the two consists, but this seems at least to have been clearly settled by the meteorological registers kept at the military posts of the United States. From a comparison of four of those registers, from posts near the center of this great valley, with others kept on the Atlantic coast in the same latitudes, it appears that the extremes of heat and cold in the basin of the Mississippi are from 5° to 6° higher and lower than on the coasts of New England. The proportion of fair weather to cloudy is as 5 to 1 in favor of the east coast. The climate of the interior, therefore, exhibits in still greater excess those extremes of temperature which distinguish the eastern coast of its continent from the western, and from the shores of Europe. The fourth region of extra-tropical America includes the parts beyond Mount St. Elias on the west coast, and, in the interior, the plains extending from the 50th parallel to the Polar Seas. The intensity of the cold in this tract of country is scarcely equalled by anything that is known under the same parallels in Northern Asia. The northernmost spot in America where grain is raised is at Lord Selkirk's colony, on Red River, in latitude 50° . Wheat, and also maize, which requires a high summer heat, are cultivated here. Barley would certainly grow as far north as Fort Chippewyan, in latitude $58\frac{1}{4}^{\circ}$, where the heat of the four summer months was found by Captain Franklin to be 4° higher than at Edinburgh. There is even reason to believe, that both this species of grain and potatoes might thrive as far north as Slave Lake, since the spruce fir attains the height of 50 feet 3 degrees farther north at Fort Franklin, in latitude 65° .

NORTH AMERICA: POLITICAL SUBDIVISIONS AND HISTORY.

The United States were colonized a century later than Spanish America; but their brilliant and rapid progress shows in a striking light how much more the prosperity of nations depends on *moral* than on *physical* advantages. The North Americans had no gold mines, and a territory of only indifferent fertility, covered with impenetrable woods; but they brought with them intelligence, industry, a love of freedom, habits of order, and a pure and severe morality. Armed with these gifts of the soul, they have converted the wilderness into a land teeming with life and smiling with plenty; and they have built up a social system so pre-eminently calculated to promote the happiness and moral improvement of mankind, that it has truly become the "envy of nations."

The republic is bounded on the north by Canada, on the southwest by Mexico, and on the other sides by the sea or the Indian lands. It now consists of forty-four States, with six *territories* and one *district*, which will be converted into *states* as soon as each acquires a sufficient population. The extent of the country, including the Indian lands stretching west to the Pacific Ocean, over which it claims a right of pre-emption, embraces 3,603,844 square miles of land. The agriculture of the United States partakes to some extent of a tropical character. The sugar cane is cultivated in Louisiana, Florida, and other states as far north as the latitude of $31\frac{1}{2}^{\circ}$. Cotton is raised in all the southeast states S. of the 37th parallel, and tobacco chiefly in the middle states. Wheat succeeds in the middle and northern states, and maize thrives in every part of the Union. Agriculture is conducted with considerable skill; but the "high farming" practised in England would not pay in America, where money is of much value and land of little. Scarcely any portion of the soil is rented in the United States; the farmers are almost universally proprietors; and when their property is extensive, which rarely happens, it is soon broken into small occupancies under the law of equal division. The advance the Americans have made in manufactures may be judged of from the fact that in 1880, according to the census then taken, there were upwards of 185,472 operatives employed in 1,005 cotton factories, and 105,307 in 2,066 manufactories of woollen goods. The iron industries gave employment to upwards of 160,000 hands, the iron produced in the country reaching over two millions of tons. In the useful arts generally America is on a level with France and England. The internal commerce of the United States is conducted with extraordinary spirit. The amount of capital expended on roads; canals, harbors, bridges, and other public works, is very great. The length of the lines of railway open for traffic now exceeds 161,255 miles, and is rapidly increasing. The extent of the foreign trade of the country, and the amount of its shipping, place it next to Great Britain in the list of commercial nations.

The population of the United States in 1900 was	
by census	76,303,387
in 1800 it was	5,308,483
Increase in 100 years.....	70,994,904

Since 1800 the rate of increase has been remarkably uniform at nearly $3\frac{1}{2}$ per cent. per annum. In 1892 the number of immigrants was 619,320, of whom 117,068 migrated from the British Isles, 130,622 from Germany, and the remainder from British North

America, Sweden, Norway, France, Austria, Italy, Switzerland, Denmark, and Russia.

Slaves were first introduced in 1619. In 1775 slavery was abolished in Rhode Island. In 1780 Massachusetts abolished it; then numerous northern states followed, and in December, 1865, slavery was abolished throughout the United States. By subsequent amendment of the constitution all negroes were admitted to all the privileges of citizenship. Thus it was enacted on March 30, 1870, that "no discrimination should be made in the United States among the citizens of the United States in the exercise of their elective franchise, or in the right to hold office in any state, on account of race, color, nativity, property, education, or creed." Every person born or naturalized in the United States is recognized to be a citizen thereof.

The American government is a pure representative democracy in which the people are recognized as the fountain of all power; and the sole object of all its mechanism is to give effect to their deliberate opinions. The federal government and the governments of the separate states are constituted on the same plan. The legislature consists in every case of two bodies, a House of Representatives chosen for one or two years, and a Senate for a period varying from two to six—all chosen by popular election, except in the case of the Federal Senate, which is elected by the legislatures of the forty-four states. The President holds his office for four years, but is occasionally re-elected for four years more.

The characteristic facts in the condition of America are the non-existence of titles, of privileged classes, of corporations in a European sense, of a landed aristocracy, of mendicity except to a very limited extent, and of an endowed church; the cheapness and efficiency of its government, the universality of education, the omnipresence of its periodical press, the high feeling of self-respect which exists in the very humblest classes, and the boundless spirit of enterprise which pervades all classes of society. The social customs and individual manners of the American may be rendered brusque, by business habits, but the American people, taken collectively, are at least as well educated and have as much intelligence and manliness as any other nation in the world.

In 1867 the territory formerly known as Russian America was purchased by the United States, and called Alaska. It occupies the northwest corner of the continent, and extends along the coast as far south as Mount St. Elias, where it is bounded by British Columbia and the southern end of Prince of Wales Island, in $54^{\circ} 40' N$. It comprises an area of about 590,884 square miles. Furs and fish are the most valuable commodities. Sitka is the capital. It has a population of over 2,000 persons. The Yukon river, about 2,000 miles long, flows through the territory. About \$20,000,000 of gold have been taken out in the past twenty years, chiefly from about Cape Nome and the valley of the Yukon.

British North America is bounded on the south by the United States, on the north by the Arctic Ocean, and on the west by Alaska. In 1867 the provinces of Ontario (formerly Upper Canada), Quebec (formerly Lower Canada), Nova Scotia, New Brunswick, Manitoba (formerly Hudson's Bay Territory), Prince Edward Island, and British Columbia, were united under the title of "The Dominion of Canada," while Newfoundland still remains independent. The executive power is vested in the sovereign of the British Empire, but is carried out by a Governor-General and Privy Council. The Parliament consists of a Senate and House of Commons. The senators are

nominated for life by the Governor General, and are 81 in number. The members of the House of Commons are elected by the people in the proportion of one member for each 17,000 souls. The seat is retainable for five years, and each member is allowed a salary and traveling expenses. Ottawa is the capital of the Dominion. According to the latest census, taken on April 1, 1901, the land area and population of the several provinces are as under:

	Area sq. m.	Pop.
Ontario.....	219,650	2,182,947
Quebec.....	344,450	1,648,898
Nova Scotia.....	20,550	459,574
New Brunswick.....	28,100	331,120
Manitoba.....	64,066	254,947
British Columbia.....	382,300	177,272
Prince Edward Island.....	2,000	103,259
North West Territory }.....	1,987,595	158,940
Unorganized Territory }.....		52,709
Newfoundland (not in Confederation).....	42,200	210,000
	3,099,911	5,579,666

In 1871 the Dominion had 2,854 miles of railway open, 1,173 miles in preparation. In 1900 there were 17,824 miles completed, and 17,657 in operation. A line (Canadian Pacific) connecting the Eastern provinces and the Pacific (5,633.5 miles) has now been completed.

SOUTH AMERICA: PHYSICAL FEATURES, ETC.

In our more particular description of the physical conformation, the geological structure, the mountains, rivers, and forests, and the climates of America, we shall first deal with the southern peninsula, as having the more strongly marked conditions.

The mountain areas of South America are, as a general rule, those which have received the thickest accumulations of sedimentary matter, and this thickness is nearly proportional to their height. During the periods of the formation of such deposits, these areas were to a great extent areas of subsidence, and since those beds which once formed the sea bottoms now constitute the highest peaks, these areas must have been subjected to subsequent upheaval. Vertical movements of this kind have occurred again and again, indicating that these areas are specially liable to disturbance, either from comparative weakness or from the greater comparative power as the moving forces. The history of the mountain chains is almost co-extensive with that of the continent itself. In the sea the beds were deposited horizontally, or nearly so; and at certain intervals the deposition was arrested, in consequence of the beds being uplifted above the sea. Each successive submergence and emergence occupied a long period of time, during which the rocks were at one time faulted, folded, and metamorphosed, and at other times denuded both by the sea and by meteoric agents. As a general rule, the strike or line of direction of the strata ran approximately parallel to the trend of the shore line on the large scale, and the dip was at right angles to their direction. During each elevation the land was uplifted in a broad band, the axis of which ran parallel to the shore of the sea in which the beds were formed. The axes of the principal folds and faults usually run parallel to the stratigraphical axis or strike. The principal ridges formed during the same period usually coincide in direction with the stratigraphical strike of the bed forming them. In the mountains of South America, and especially in the Andes, several of these groups of ridges, formed at different periods, combine to make up a single system of mountains. The high range of mountains which extends from the most southern parts of South America, and runs ap-

proximately on the same meridian of 72° to the isthmus of Panama, forms the Andes. These consist of a vast rampart, having an average height of some 11,000 or 12,000 feet, and a width varying from 20 to 300 or 400 miles. In most places the chain rises to heights of several thousand feet, and upon this chain rest two or three principal ridges of mountains, enclosing lofty plains or valleys, separated one from another by mountain knots, which mark the spots where ridges belonging to different systems intersect. In one sense, the lofty plains of the Desaguadero, Quito, and others, are valleys, since they are encompassed by mountains; but in a certain sense they are plateaus, since they form the broad summit of the range or platform on which the bounding ridges themselves stand. Further details respecting the Andes are given under ANDES, and in the geological remarks of this article.

Three branches of transverse chains proceed from the Andes, nearly at right angles to the direction of the principal chain, and pass eastward across the continent, about the parallels of 18° of S. and 4° and 9° of N. latitude; thus forming the three natural areas of the Orinoco, Amazon, and La Plata river basins. The most northern of these is "the Cordillera of the coast," which parts from the main trunk near the south extremity of the lake Maracaybo, reaches the sea at Puerto Cabello, and then passes eastward through Caraccas to the Gulf of Paria. Its length is about 700 miles, and its medium height from 4,000 to 5,000 feet; but the Silla de Caraccas, one of its summits, has an elevation of about 8,632 feet; and its western part, which is at some distance from the sea, contains the Sierra de Merida, 15,000 feet in height. The second transverse chain is connected with the Andes at the parallels of 3° and 4° north, and passing eastward, terminates in French Guiana, at no great distance from the mouth of the Amazon. It consists properly of a succession of chains nearly parallel to the coast, and is sometimes called the Cordillera of Parimé, but is named by Humboldt the "Cordillera of the Cataracts of the Orinoco," because this river, which flows amidst its ridges in the upper parts of its course, forms the cataracts of Maypure at the point where it descends into the plains. Its mean height is estimated at 4,000 feet above the level of the sea; but at 70° and 75° W. longitude, it sinks to less than 1,000 feet, and at other points rises to 10,000. This chain divides the waters of the Orinoco and the rivers of Guiana from the basin of the Amazon, and is covered with magnificent forests. Its breadth is supposed to be from 200 to 400 miles, and it encloses amidst its ridges the great lake Parimé, in longitude 60°, and several of smaller size. At the Caratal goldfield, which lies south of Angostura, the range is about 60 miles across, and the watershed about 1,100 feet above the sea. On a table-land forming part of it, about the 67th degree of longitude, the Cassiquari forms an intermediate channel which connects the rivers Orinoco and Negro, so that, during the annual floods, a part of the waters of the former flows into the latter. This singular phenomenon was made known long ago by the Spanish missionaries, but was thought to be a fable till the truth was ascertained by Humboldt. The length of this chain is about 1,500 miles. The third transverse chain leaves the main trunk near 17° 25' S., and extends almost as far as Santa Cruz, near the river Mamore. Some of the mountains in the western part are of considerable height. South of this range are a number of ridges having an east and west direction, an average height of about 10,000 feet, and terminating in the plains near the

Paraguay. This country, which divides the waters of the Amazon from those of the Plata, is a broad plateau of elevated land, rather than a distinct mountainous ridge, and consists of low hills or uneven plains, with very little wood, presenting in some places extensive pastures, and in others tracts of a poor sandy soil. Its average height probably does not exceed 2,000 or 3,000 feet above the level of the sea.

The mountains of Brazil, which are of moderate height, and occupy a great breadth of country, form an irregular plateau, bristled with sharp ridges running in a direction approximately parallel to the eastern coast, connected by offsets running in a more or less east and west direction. They extend from 50° to 25° of south latitude, and their extreme breadth may be about 1,000 miles. Between Victoria on the north and Morro de St. Martha on the south, a range with numerous curves lies a little way back from the coast, and is, for the greater part of its length, known as the Sierra do Mar; somewhat farther inland is a higher range, the different parts of which have different names, but it is best known as the Sierra de Mantiqueira. It contains the highest peaks in Brazil, among which may be mentioned Mount Itacolumi, famous for the gold and diamond yielding strata in its vicinity; the Pico dos Orgaos, which is 7,700 feet high; and Itambe, 8,426 feet. Some of the peaks are believed to be even higher. West of this the uplands of Brazil stretch far into the interior, and at length sink into the great central plain through which flow the Paraguay and its tributaries.

Although large areas of South America remain as yet unexplored by geologists, the researches of D'Orbigny, Humboldt, Boussingault, Darwin, Forbes, Agassiz, and many other travelers, suffice to give an approximately correct general view. This is mainly owing to the simplicity of the stratigraphy of the country. The same groups of rocks spread over such extensive areas, that, from what is seen in the areas which have been examined, we can safely infer the general condition of those which have not been explored. The general disposition of the rocks is as follows: The oldest rocks, which are Pre-Silurian, possibly Laurentian, form the outermost rim of the continent of which the N. E. and S. E. corners have probably been swept away. These corners now correspond with the mouths of the Orinoco, the Amazon, and the La Plata rivers. Within this basin, and following close upon these old rocks, are schists and quartzites, which are in all probability of Silurian age. These enter largely into the transverse ranges by which the central hollow is subdivided into three basins. Within this again are sandstones and limestones, usually referred to the Carboniferous period, which also form part of the transverse ridges. A band of rocks of secondary age follow, some of which are believed to be Triassic, while others are identified as Cretaceous. Tertiary beds, some of Miocene date, together with Post-Tertiary beds, cover the largest part of the areas of the great river basins and the hollows in the mountain range, and also occur on the seaward flanks of the principal chains.

By following the development of these beds, we shall be able to give a brief account of the growth of the present continent. In the Argentine Confederation a few bosses of gneiss protrude through the more recent beds constituting the pampas. Granite, supporting gneiss and quartzite, occurs along the coast of Chili. In Bolivia we find a range of granitic mountains which have a general direction somewhat to the E. of N., and which are flanked on either side by zones of gneiss and quartzite. The gneiss also pro-

vails along the shores of Peru, Ecuador, and New Granada, or, to call it by the name which it received in 1861, Colombia. The gneiss is again seen at the eastern base of the Andes, in the last mentioned state, associated with quartzites, and both these can be traced along the Venezuelan coast. Gneiss is largely developed near Angostura, and has a strike approaching E. and W. At Limones, which is near the Caratal gold-field, the country consists largely of granite and gneiss, which latter lies here a little to the E. or to the W. of N. In Brazil the gneiss forms a long band from Bahia to the southern portion of the province of Santa Katharina. Near the coast it rests upon and apparently passes into granite; but towards the west, as far as the Mantiqueira chain, it gradually becomes more and more schistoid. Gneiss, again, is met with in the mountains which stretch through the Bolivian provinces of Moxos and Chiquitos. It has not been ascertained if these older rocks appeared above the waters before the deposition of those which follow, and which will next be noticed.

In Chili the succeeding rocks are slaty schists. In Bolivia the mountainous district crossing the country is largely composed of talcose schists, which, where exposed to the weather, have formed by their decomposition a layer of clay; in advancing from the east towards the west the schists become more and more crystalline, and are at last replaced by gneiss. This, as has already been stated, rests against granite, on the west side of which gneiss is again brought in by an anticlinal arrangement of the beds, and dips between a thick mass of schists, which constitute the great bulk of the Andes in this district. In this mountain range the lower portion of the formation is mainly siliceous schist, alternating with beds of compact quartz; above this come talc-bearing quartzites, alternating with slaty schists, which latter become more and more prevalent as we ascend in the strata, and at last constitute the predominating rock. They form, indeed, the crest of the range; the thickness of the formation may be roughly estimated at 10,000 feet. These rocks are much disturbed and faulted against other and probably newer rocks, which with them constitute the great bulk of the lofty eminences in the range of which Mount Illimani forms so conspicuous a feature. The lower argillaceous schist, which is associated with gneiss all along the Pacific coast from lower Peru to Panama, possibly belongs to this group of rocks. In the high valleys of Ecuador the oldest rocks visible are granite, gneiss and schists, which are frequently in a vertical position. The schistose group appears to be absent on the east side of the Andes in Colombia, as also along the coast of Venezuela. In the mountain range south of the Orinoco, hornblende, talcose, and mica schists again appear on a large scale, more especially in the Caratal district, where auriferous veins occur. In Brazil the micaceous and talcose schists enter into the composition of the Mantiqueira chain and of the uplands to the west; they probably pass beneath the valley of the Panama, since they occur to the west of it, and extend through the provinces of Goyaz and Matto Grosso, so as to approach within a moderate distance of the similar strata in Bolivia. They are associated with talc-bearing quartzites, which are famous for the diamonds and auriferous particles they have yielded in the district around Mount Itacolumi. The soil is usually a clay, such as would result from the decomposition of talcose schist; but we shall have occasion to refer to the soil of South America subsequently. Some of these rocks in various parts of the continent have yielded Silurian fossils. Facts are not sufficient yet to warrant the correlation

of these strata with those of other countries, or to settle how far they belong to distinct geological periods. The prevalent strike of the rocks is about east and west, but sometimes the strike approaches to a north and south direction. At any rate, the rocks which overlie them do so unconformably, indicating that, prior to the deposition of these newer rocks, and had appeared at least once on areas now constituting part of South America. At this early date the continent was represented by a few islands only; one corresponded with part of Brazil, another with parts of Venezuela and Colombia; perhaps a third more or less with Peru, Bolivia, Ecuador, and Chili; while a few small islands appeared where now we have the pampas. These were the nuclei around which the present land has accumulated, and already we see faint indications of the existing outline and broad geographic features of the future continent.

The next group of rocks are always in stratigraphical discordance with those beneath them, and, in consequence of the highly metamorphosed condition of these on the west side of the continent, it is difficult to correlate them with the rocks of Brazil. In the Andes of Chili they are represented by enormous stratified masses of quartzose porphyries, which there is good reason to believe are metamorphosed argillaceous schists and feldspathic sandstones, into which rocks they have been seen gradually to pass. These porphyries not only form the great bulk of the principal chain of the Andes, but also the smaller chain on the west, the interval between them being formed by the longitudinal valley of Chili. Further west they rest on syenitic rocks, beyond which come the older rocks already noticed. On passing into Bolivia, we find that to the west of the great fault developed there, the beds consist of micaceous sandstones and dark bituminous schists, which are believed to be the equivalents of the porphyries of Chili. Such formations constitute the west slope of the Andes from Sorata to Illimani, and also form two bands, one stretching from Illimani to Cochabamba, the other between Calamarca and Chayanta. Towards the west they dip beneath black bituminous and siliceous limestones, which are well developed near Tiahuanaco. Carboniferous strata with seams of coal occur near Pisco and Arequipa in Peru. In Brazil the beds which succeed those previously mentioned are quartzites, rich in mica and magnetic oxide of iron; talcose schists; and crystalline limestones, containing a great deal of talcose. These rocks form the highest regions and loftiest peaks in Brazil. Unconformably upon these rest micaceous sandstones and argillaceous schists, which occupy the western part of St. Paul province between Ytu and the banks of the Parana. In Mount Arasoyaba and some other places, a carboniferous limestone succeeds and is overlaid by a thick white or yellowish sandstone, siliceous limestones, and bituminous schists. The limestones occupy most of the area between the Uruguay and the Parana. In the Diamantina district the carboniferous limestone is overlaid by red sandstone, which belongs to the succeeding group of beds. The beds in Brazil appear to be fuller than those on the west side of the continent, and represent probably both the Devonian and Carboniferous periods. Rocks of this age are also exposed in a narrow band round portions of the basin of the river Amazon. The strata next in succession are of the secondary age. The lowest formation is a red sandstone, which is spread over a very extensive area. It is remarkably well developed in Chili, where, together with more recent beds, it is a marked feature in the crest of the Andes. In the

small chain to the west it is associated with conglomerates. In the small chain of Colorado, near Tiahuanaco, a thick conglomerate rests on the older limestones, and supports red sandstones and conglomerates dipping west between marls. The red sandstone extends across the province of Carangas, and uninterruptedly over both slopes of the western Cordillera. In the desert of Atacama the red sandstone, with the overlying marls, forms a number of parallel chains directed north and south. Red sandstones and conglomerates form the base of the Cordilleras of Quito; they stretch north into the basins of the Magdalena and Cauca rivers, and east over the basin of the Orinoco. In the province of Bahia, and far away to the north, there is a great development of red sandstone. The age of these sandstones has been variously stated; their stratigraphical position would indicate a secondary age, and possibly they may be Triassic. After their deposition, and prior to that of the marls, syenitic rocks were introduced among the strata in the Andes, causing the red sandstones, as also the older sandstones and schists, to be converted into porphyries. This eruption was also accompanied by, and probably connected with, the formation of auriferous veins, the elevation of the strata, and the faulting of the rocks. The strike of the strata, as also of the faults, was about 80° to the E. of N., but subsequent movements have modified the direction in places. The red sandstone has a similar strike from Venezuela in the north to Magelhaen's Strait on the south, and this favors the idea that all are of the same age. Several of the ranges in the Andes have a corresponding direction. As the sandstone is believed to underlie the basins of the great rivers, it appears that during its deposition South America was still represented by a few large islands only. Its elevation gave rise to north and south trending mountains, whereby these scattered portions were connected, and the Andes received their first development. The great features of the continent were then first distinctly marked out, and only a few gaps remained to be filled up. The next succeeding period, represented by strata, is characterized by saliferous and gypseous marls, which rest unconformably on the rocks beneath. In Chili they occur in the lower plains, or abut against the western spurs of the Andes; but they have been largely denuded, so that they now occur in isolated plateaus or basins, and there is a patch capping the lofty Aconcagua. It is stated that in Chili the marls, or at least some of them, are Liassic. In Bolivia, also, they form plateaus between San Andres and the mountains of Tarija. Here they consist of alternations of greenish marls and wine-colored beds supporting limestones, with interstratified beds of gypsum and saliferous clay. There are beds of gypsum and limestone in the Orinoco plains. Marls are associated with marly sandstones in the Gulf of Bahia and in the plains of Reconcavo. These beds are arranged along strikes which are approximately east and west, and their elevation is apparently connected with the formation of chains running in the same direction, as, for instance, most of the lateral spurs from the Andes. Some geologists think it is also connected with the east and west faults, through which, in the Andes, labradorite and hypersthene rocks have been erupted. This eruption, it is said, has caused the metamorphism of the calcareous rocks into crystalline limestones, marls into jaspers, and red sandstones into porphyries; and has also given rise to the copper-bearing veins. Calcareous beds occupy large areas in Venezuela, Colombia, and other parts

of the continent. Miocene strata occur in Venezuela, and probably in other districts. Finally, there are deposits of Post-Miocene date, which chiefly belong to the Post-Pliocene and recent periods, and which cover most of the lower lands along the coasts and in the interior of the continent. In Chili they occur in the valleys, and fill up the gulfs in the old granite range near the coast. Here the succession is a calcareous sandstone abounding in marine shells and beds of lignite; above this is a pumiceous conglomerate, which passes in places into a pebbly conglomerate, and then follow the marine sands which stretch from Coquimbo across the desert of Atacama. The most recent formation is drift, which occurs in patches and sheets. In the valley plains of the Desaguadero there are clays and sandy marls overlain by pumiceous conglomerates, which near La Paz are surmounted by drift. Near this place the drift is many hundred feet thick, and formed of large blocks; but, on receding from the mountains, it passes into a sand which encircles the plains of the Desaguadero, which are chiefly formed by limestone deposits, such as concretionary limestone, which abounds in the fossil remains of plants and fresh water shells. The lacustrine beds approximate in age to the marine tertiary beds near the coast. In Peru the pumiceous conglomerate is overlaid by drift. Tertiary beds occur at Guayaquil in Ecuador, while in the valley of Quito there are enormous layers of pumice, scoriæ, and drift, which last has yielded the remains of various Post-Pliocene mammals and terrestrial shells. Drift with similar remains occurs in the lower grounds of Colombia. In the Gulf of Bahia there are recent beds; and near St. Paul, as also in many other parts of Brazil, there are patches of lacustrine deposits. On the west side of the continent the pumiceous conglomerate is intimately connected with trachytes, and indeed is formed from them. It is intermediate in age between the lacustrine beds, the marine deposits near the shore, and the drift, which is in its turn covered by the more recent lava overflows; and it is in this intermediate age that the upheaval of the principal chain of the Andes occurred. The ranges and faults which are assigned to this period, probably Pliocene or Post-Pliocene, run very nearly north and south. This elevation did not materially alter the extent of land west of the Andes, its general effect being to add a strip about thirty miles in width. On the east the change was great, since the larger proportion of the great central plain then emerged, and thus connected the high lands on the east, west, and north into one great continent. The eruption of the trachytes, which form so marked a feature in the Andes, was accompanied by a metamorphism distinct in character from those of earlier ages. The rocks were then subjected not only to heat and water, but also to acid vapors, which changed the feldspar into sulphates of alumina and iron, salt into anhydrous sulphate of soda; and, probably, by freeing the chlorine and iodine, originated the chlorides and iodides which are so abundant in the argentiferous veins. Since the drift there has been a slight elevation along a meridional axis.

Such is a brief account of the growth of South America. We must, however, mention that Professor Agassiz and his coadjutors believe that the red soil and immediately underlying beds seen near Rio Janeiro and in the valley of the Amazon, are true glacial formations, and infer that the similar beds which are spread over such an enormous area in South America have been formed under similar conditions. Professor Agassiz has found moraines and ice-transported bould-

ers in various places in the mountains of Brazil, as also indications of valley glaciers. Professor Orton has found marine shells in these beds at Pebas in Ecuador.

The foregoing sketch indicates that there have been several periods of volcanic activity; and that, so far as our present knowledge goes, such activity has only been manifested along the line of the Andes. Volcanic rocks have rarely been observed on the east side of the continent, but some of the Tertiary and Post-Tertiary beds of the plains contain matter which has been showered upon them during eruptions, and which now forms a portion of the Pampean deposits. At one period or other the whole system of Andes has been subjected to volcanic disturbance, but at the present time the active volcanoes occur in groups more or less widely separated. The most southern active volcano is Corcovado, in 43° 10' S. There are, besides, some twenty or more volcanic cones, of which about a dozen are known to be active. Bolivia has one or two active vents, and Peru several; but it is in Ecuador, with its dozen ignivomous vents, that have occurred the grandest and most frequent displays. Colombia has four or five volcanoes. With the exception of the Moluccas, no country in the world has had so many and so destructive earthquake shocks as South America. But these are concentrated, both as regards frequency and strength, along the Andes, and more particularly their western slope. Comparatively few are felt in the plains to the east of them; but occasionally it happens that shocks are felt at points on the opposite slopes of this great range without being perceived in the intermediate higher regions. Peru seems to be the principal focus of action; and next to it in importance as a seismic area comes Chili; but although some earthquake shocks spread over both these areas, there does not seem to be the community of action which we should expect between the two areas. In Peru the maxima of seismic intensity were in the decades ending 1590, 1610, 1660, 1690, 1710, 1720, 1730, 1750, 1770, 1790, 1840, 1870. In Chili they occurred in the decades ending 1580, 1640, 1650, 1660, 1690, 1730, 1780, 1800, 1820, 1840, 1850. Nearly every other portion of the continent is subject to earthquakes. Bolivia, which lies between Peru and Chili, is comparatively free from them, as also are Brazil, Patagonia, and the Argentine Confederation, but they are more frequent in Ecuador, Colombia, Venezuela, and the three Guianas.

SOUTH AMERICA: POLITICAL SUBDIVISIONS AND HISTORY.

Brazil is the largest state in South America, and enjoys the greatest combination of natural advantages. It is bounded on the south, west, and north, by La Plata, Paraguay, Uruguay, Bolivia, Peru, Ecuador, Colombia, Venezuela, and Guiana. Embracing an area of 3,100,000 English miles, it is nearly as large as Europe, and is capable of supporting a much greater population. Its climate is probably cooler and more salubrious than that of any other extensive tropical country; and every part of its soil is rich and fruitful, as its magnificent forests and the exuberance and boundless variety of its vegetable productions attest. Its commercial advantages are admirable. No country in the new world has the same facilities for carrying on intercourse with Europe and with all its neighbors. The Amazon, with its numerous branches, the Parana, the Tocantins, the St. Francisco, and other streams, supply the most remote parts of the interior with easy means of communication with the sea. Brazil possesses iron, copper, and probably all the other metals; but her mines of gold and diamonds are

remarkably rich. Her most valuable productions for exportation are cotton, sugar, coffee, hides, tobacco, vanilla, dyewoods, aromatic plants, timber, etc. Her commerce is much greater than that of all the Spanish colonies put together. The Brazilians are lively, irritable, hospitable, but ignorant, superstitious, and rather inclined to indolence. Their acquisition of independence in 1822, however, worked like a charm, and produced an extraordinary change in their industry, opinions, and modes of thinking. There are numerous schools, but although the education is gratuitous, they are not well attended. The advance literature has made will be allowed to be great when it is remembered that printing was unknown in the country in 1807. According to the constitution introduced by Dom Pedro, the legislature consisted of a Senate of 52 members, who held their places for life, and a House of Congress of 107, elected by the people for four years; upon the acts of both of which bodies the emperor had a negative. The members of the lower house were chosen by elections of two stages. The householders of a parish met and appointed one elector for every thirty of their number, and the electors thus chosen met in districts and chose the deputies. The members of both houses received salaries. The executive power was invested in the emperor, assisted by a ministry and a council of state.

The population of Brazil amounted to 3,671,558, according to returns published in 1818, and procured probably for the purpose of taxation. This was exclusive of the wandering Indians. In 1823 it was estimated at 4,000,000 by Humboldt. M. Schoeffler carries it to 5,700,000, and an estimate for 1867 makes it 9,858,000, comprising 8,148,000 free persons, and 1,674,000 slaves. Slavery was abolished in 1888, the census of 1890 giving the population at 14,333,915.

Brazil, after remaining a colony of Portugal until 1822, threw off the yoke of the mother country, and became an independent empire, in which political condition she remained till November, 1889, when the emperor, Dom Pedro, abdicated and sailed for Portugal, and a republic was proclaimed.

The portion of South America next to the isthmus includes the states of Venezuela, Colombia, and Ecuador. From 1820 until 1831, when a separation took place, it formed one state under the name of Colombia; which name has recently been assumed by the republic long known as New Granada. The territories of these three states are bounded on the south by Peru, on the southeast and east by Brazil and Guiana, on the other sides by the sea, and embrace an area of 1,020,000 square English miles. The soil is fruitful and the climate salubrious, except along the coast and in a few other low situations. The eastern part consists chiefly of the llanos or steppes of the Orinoco, which are very hot; the western, of the mountain ridges of the Andes, which support tracts of table-land where the blessings of a temperate climate are enjoyed, and the cerealia of Europe can be successfully cultivated. The tropical vegetation extends to the height of 4,000 feet; from 4,000 to 9,000 is the region where wheat, barley, and leguminous plants thrive. Above the level of 9,000 feet the climate becomes severe; and at 15,700 feet vegetation ceases. The situation of Colombia is highly favorable for commerce. It has excellent ports on both seas; and being mistress of the isthmus of Panama, it has superior facilities for establishing a communication from the one to the other. The Orinoco and the Amazon afford the inmost districts of Venezuela and Ecuador the advantages of water carriage to the ocean. The Cassiquiari, an intermediate channel, by which the

Orinoco bifurcates or connects with the Amazon (a remarkable hydrographical phenomenon), is within the limits of Venezuela. The territory contains much gold and silver—the former in alluvial deposits; it has mines of copper and mercury also, with platinum, iron, and coal. Its tropical productions are similar to those of Brazil; but it has as yet cultivated few articles for foreign markets, and its exports are inconsiderable. The civilized population of this country is chiefly located in the districts near the coast, and in the high valleys or table-land of the Andes. Its amount, according to the *Statesman's Year-Book*, is—

Venezuela.....	2,323,527
Colombia.....	4,000,000
Ecuador.....	1,400,000
	7,723,527

It is always of importance to know in what proportions the different races are blended, but on this subject we have only approximate data. In Colombia the whites form about half of the population, the Indians about one-third, and the negroes about one-tenth, the remainder being of mixed blood. In Venezuela the whites form about one-third, the Indians about one-thirtieth, and Zamboes (from Indians and negroes) about one-half. In Ecuador the proportions are, roughly—whites one-sixth, Indians nearly one-half, negroes one-thirtieth.

All the three states are republican. See VENEZUELA, COLOMBIA, and ECUADOR.

The Argentine Republic, or La Plata, is, in point of natural advantages, the second state of importance in South America. It is bounded on the west by Chili; on the north by Bolivia; on the east by Paraguay, Brazil, Uruguay, and the sea; and on the south by Patagonia. It embraces an area of 515,000 square miles, if we include Tucuman, Salta, Santiago del Estero, and Jujuy, which scarcely acknowledge its authority. Nearly the whole territory of this republic consists of open plains destitute of timber, called *pampas*, extending from the Atlantic and the river Paraguay to the Andes. The eastern part of these plains exhibits a vigorous growth of herbage, intermixed with a forest of gigantic plants, 9 or 10 feet high, which have been called thistles, but are now known to be artichokes; in the middle they are covered with grass; and the western division, which extends to the foot of the Andes, consists of barren sandy plains, thinly sprinkled with shrubs and thorny trees. The openness and dryness of the country, however, render it healthy; and by the Parana, the Paraguay, and their branches, it possesses a great extent of natural inland navigation. It has mines of gold, silver, copper, lead, and probably iron; but its mineral riches have been greatly diminished by the separation of Potosi, Cochabamba, La Paz, and other provinces now forming part of Bolivia. The force of this republic lies almost entirely in the wealth, intelligence, and commercial spirit of its capital, Buenos Ayres, which (1901) contained 836,381 souls, including a large proportion of foreigners. A small number of *estancias*, or grazing farms, are sparingly diffused over its boundless plains, the proprietors of which keep multitudes of horses and mules, flocks of sheep, and vast herds of cattle; the latter being chiefly valued for their skins. These people are a bold, frank, hardy, half-civilized race, who live isolated in the wilderness, and scarcely acknowledge any government. The census of 1901 gives a total population of 4,794,149. See ARGENTINE REPUBLIC; and for the two small states formed out of the northeastern portion of

its territory, see PARAGUAY and URUGUAY. Entre Rios, formerly a separate state, is now a province of La Plata.

Chili extends along the coast of the Pacific from 25° to 44° of south latitude; its length is 1,300 miles; its breadth varies from 30 to 120; and its surface, exclusive of Araucania and the district beyond the 44th parallel, is estimated at 279,901 English square miles. The country consists properly of the western slope or declivity of the Andes, for the branches of the mountains running out in tortuous directions from the main trunk reach to the seashore. It enjoys an excellent and healthful climate; severe cold is unknown in the inhabited parts, and the heat is seldom excessive. The useful soil bears a small proportion to the entire surface of the country, consisting merely of the bottom of the valleys. It has rich mines of gold, silver, and copper in the northern provinces; but very few of them can be worked in consequence of the absolute sterility of the adjacent country. Its two northern provinces, occupying 450 miles of the coast, are nearly perfect deserts. The soil continues extremely dry, and yields nothing without irrigation, till we reach the latitude of 35°; and it is believed that not one-fiftieth part of the country is fit for cultivation. But south of the river Maule the land is covered with fine timber, and bears crops of wheat and other grain without the aid of any other moisture than what is supplied by the atmosphere. This is in truth the fine and fruitful part of Chili; and the project was once entertained of selecting its chief town, Concepcion, for the seat of the government. Chili has no manufactures, and is unfavorably situated for commerce. It has no navigable rivers, while its mountainous surface is an obstacle to the formation of roads; but nevertheless it has now upwards of 1,700 miles of railway opened. A representative constitution was established in Chili in 1833. An enumeration dated 1900 makes the population, exclusive of Araucania (with 70,000 aborigines), 3,128,095. See CHILI.

Peru may be regarded as a continuation of Chili, consisting of the western declivities of the Andes, from the 4th to the 22d degree of such latitude, with the addition of a considerable tract on the east side of the mountains between the 4th and 15th parallels. There are few countries in the world which have a more singular physical character than the western part of Peru. It is a belt or zone of sands, 1,240 miles in length and from 70 to 600 in breadth, with inequalities of surface which might be called mountains if they were not seen in connection with the stupendous background of the Andes. This long line of desert is intersected by rivers and streams, which are seldom less than 20 or more than 80 miles apart, and on the sides of which narrow strips of productive soil are created by means of irrigation. These isolated valleys form the whole habitable country. Some of the large rivers reach the sea; the smaller are either consumed in irrigating the patches of cultivated land or absorbed by the encompassing desert, where it never rains, where neither beast nor bird lives, and a blade of vegetation never grew. No stranger can travel from one of these valleys to another without a guide, for the desert is trackless; and the only indications of a route are an occasional cluster of bones, the remains of beasts of burden that have perished. Even experienced guides, who regulate their course by the stars, the sun, or the direction of the wind, sometimes lose their path, and they almost inevitably perish. Of a party of 300 soldiers thrown ashore by a shipwreck in 1823 on one of these

desert spaces, nearly a hundred expired before they reached the nearest valley. Ignorance and wonder have been busy with this singular region; legends are current, which tell that descendants of the ancient Peruvians have lived in some of these mysterious valleys, hid from the knowledge of their merciless invaders, since the days of the Incas. We have no reason to believe that more than one acre in a hundred of maritime Peru will ever be available for the sustenance of mankind. The country has two advantages—its mines of the precious metals, and a temperate and delightful climate, in consequence of the absence of rain and the fogs which intercept the solar heat. It can never be rich in the proper sense of the term, or make much progress in the improvements which depend upon a dense population. Like Chili, it has no navigable rivers—and nature has deprived it of the means of forming good roads. There are indeed few countries in the world whose natural advantages have been so much overrated as Peru; and it requires little sagacity to discover that its future career cannot correspond with its past celebrity. The districts east of the Andes, which have a hot climate accompanied with a rich soil, will ultimately be the most valuable part of the country; but their secluded situation and want of communication with other countries must keep them long in a backward state. The government is republican. Peru comprehends a surface of 695,733 square miles; the capital, Lima, contained in 1896 a population of 120,000. In 1896 a rough census was made which gave 4,610,000 as the entire population of the republic. It was also estimated that the proportion of races were:

Indians.....	57 per cent.
Mixed races.....	23 " "
Spaniards, Negroes, Chinese, etc.....	20 " "

Bolivia, or Upper Peru, lies eastward of Lower Peru, and is bounded on the south by the Argentine Republic, and on the north and east by Brazil. It is of an irregular form, and comprehends a space of 473,300 square miles. The climate is pleasant and healthful, the soil is generally dry, and in the eastern parts, as well as the elevated table-land, its aridity produces barrenness. Nature, however, as a compensation for its other disadvantages, has bestowed upon it some of the richest mines in the world. The country was erected into an independent state only in 1826, and named Bolivia in honor of its liberator, Bolivar. It has a small strip of barren territory on the shores of the Pacific Ocean, between the 22d and 25th parallel; but it is, properly speaking, entirely an inland country, and more deficient in the means of communicating with foreign nations than any other state in America. See BOLIVIA.

Guatemala or "Central America" originally occupied all the narrow part of the continent from the 83d to the 94th degree of west longitude, extending 800 miles in length, and covering a space of 130,000 square miles. The surface of the country is hilly, and in most parts, mountainous; the climate warm and very moist. The mineral wealth of the country is not great; but this is compensated by the richness of its soil and its excellent commercial position. It was a federal republic, but its five provinces have now become independent states. Humboldt estimated the population of the states at 1,600,000. According to a statement furnished to Mr. Thomson, a former British envoy, by the government, it was 2,000,000; while the most recent of the estimates made by the resident officials give a total of 2,335,019, viz:

Guatemala (1900)	1,574,340
St. Salvador (1901)	1,006,848
Honduras (1900)	587,500
Nicaragua (1900)	500,000
Costa Rica (1899)	309,683
	3,978,371

The proportions of the different races have been estimated as follows:

	Humboldt.	Thomson.
	20 per cent.	20 per cent.
Whites and Creoles.....	28	40
Mixed classes.....	28	40
Indians.....	52	40

Mexico is the most populous and powerful of all the new states erected in America since the commencement of the present century. Previous to the war with the United States it embraced an area of 1,600,000 square miles, which was reduced to 1,030,442 by the cession of the northern provinces in 1848. About three-fourths of the surface consists either of mountains or table-land, raised from 5,000 to 10,000 feet above the sea. Owing to this extraordinary elevation, even those parts of the country which lie within the torrid zone (the low ground on the coast excepted) enjoy a dry, cool, and salubrious atmosphere; but this advantage is counterbalanced by the insufficient supply of moisture and the rapid evaporation resulting from the same cause, which render the soil generally rather arid, and in many parts absolutely barren; by the smallness of the rivers and the almost entire absence of inland navigation; and by the obstacles which the steep and rugged ascents from the coast present to land-carriage. The republic is, besides, almost destitute of ports on the Atlantic side. Mexico is extremely rich in the precious metals; and there are few regions upon which nature has lavished so great a variety of vegetable productions, or where the plants fitted to the coldest and the hottest climates may be seen so nearly in juxtaposition. Formerly individual proprietors possessed immense tracts of land and boundless wealth, while all the great towns swarmed with beggars, and thousands fell a sacrifice to famine from time to time. The Mexican constitution, which is federal and almost a literal copy of that of the United States, was established in 1824. The distinction of *castes*, which was maintained in the greatest rigor under the colonial system, has now disappeared, and power and office are open, not only legally but practically, to men of all colors. The African blacks formed an extremely small proportion of the Mexican population at all times; and since the revolution slavery has ceased. The number of inhabitants was estimated at 6,800,000 by Humboldt in 1823, and classified as follows:

	Numbers.	Proportions.
		19 per cent.
Whites.....	1,230,000	17
Mixed races.....	1,800,000	27
Indians.....	3,770,000	54

Mr. Ward states that very few of the whites, so called, are free from a mixture of Indian blood; and now when the odious distinctions founded on complexion are abolished, they readily acknowledge it. Mr. Ward estimated the population at 8,000,000 in 1827. In 1900 that of Mexico, with its present boundaries, was estimated to be 13,545,462. See MEXICO.

Hayti, called formerly Hispaniola and San Domingo, was a colony belonging partly to France and partly to Spain till 1791, when the blacks rose in arms, killed a number of whites, and expelled the rest. The attempts of England in 1793, and of France in 1801, to conquer the island, both failed, and Hayti has at length been acknowledged an in-

dependent state by all the great powers, including France. The island, which contains about 28,000 square miles, is remarkably fertile; but its climate, like that of the West Indies generally, is rather unhealthy. The population, which before the revolution was estimated at 600,000, is now said to amount to 960,000 or 1,200,000, and it is almost entirely composed of blacks and mulattoes. The island formed one state till 1844, when the eastern or Spanish portion revolted, and established its independence. It is now undergoing the horrors of internecine warfare. The western portion, retaining the name of Hayti, was formed into an empire under Faustin I.; but in 1867 a republican constitution was proclaimed. After long negotiations, the French government agreed in 1838 to acknowledge the independence of Hayti on condition of the latter paying 60,000,000 of francs by small annual installments continued for 30 years. The money was destined chiefly to indemnify the French proprietors who were chased from the island in 1791. Nothing has been paid of late years.

The multifarious nature of the subject prevents us from attempting any description of the West India colonies, insular and continental. The islands have been variously denominated, but the most convenient division seems to us the following:—1. The Greater Antilles, comprehending Cuba, Hayti, Jamaica, and Porto Rico; 2. The Lesser Antilles, extending in a semi-circle from Porto Rico to the coast of Guiana; 3. The Bahama Isles, about 500 in number, of which, however, only a small number are inhabited.

The British colonies are 18 in number, viz., 16 *insular*—Jamaica, Antigua, Barbadoes, Dominica, Grenada, Montserrat, Nevis, St. Kitts, St. Lucia, St. Vincent, Tobago, Tortola, Trinidad, Bahamas, Bermuda, Falkland Island; and 2 *continental*—British Guiana and Honduras. The colonies contained a population of about 2,500,000 in 1899, of whom probably four-fifths were persons of color.

The larger islands are Cuba and Porto Rico. Cuba has an area of 35,994 square miles, and in 1899 the population was 1,572,797. Porto Rico has an area of 3,600 square miles, and in 1899 had a population of 953,243 persons. In 1867 there were upwards of 700,000 slaves in these two countries.

In August 1872 the Spanish government issued a decree ordering that arrangements should be made for the gradual emancipation of the slaves; and in December 1872 a bill was laid before the Spanish Cortes for the abolition of slavery in Porto Rico in 1873; so that slavery is now extinct throughout all America.

The French colonies in the West Indies include Martinique, Guadeloupe, and some smaller isles; and on the continent, Guiana. According to a recent authority the population of these colonies was 392,400.

The Dutch have Surinam on the continent, with the islands of Curaçoa, St. Eustatius, and St. Martin.

In 1900 the population of the islands was 51,693, and of Surinam 67,128, occupying an area of 46,060 English square miles. Slavery has ceased since July 1863, when the Dutch government compensated the owners for 44,645 slaves.

The Danes have the small islands of Santa Cruz and St. John, containing a population of 25,698 in 1901, of whom most are freed slaves, and St. Thomas, which had in the same year a population of 14,463. St. Bartholomew, another of the Lesser Antilles, belongs to Sweden.

Both Americas, with their islands, embraced in the year 1900 twenty-one independent states, and various colonies belonging to six European powers. The former are—1. The United States of North America;

2. Brazil; 3. Mexico; 4. Venezuela; 5. Colombia; 6. Ecuador or Quito; 7. Peru; 8. Bolivia or Upper Peru; 9. Chili; 10. La Plata, or the Argentine Republic; 11. Uruguay; 12. Paraguay; 13. Patagonia; 14. Costa Rica; 15. Mosquitia; 16. Guatemala; 17. Honduras; 18. Nicaragua; 19. San Salvador; 20. Hayti; 21. San Domingo. The colonies belong to Britain, Denmark, Sweden, Holland, France, and Spain. Patagonia is merely the geographical name of a district of Chili, occupied by independent tribes of Indians; Mosquitia, or the Mosquito coast, is a small Indian state ruled by a native king; and Hayti is a negro republic proclaimed in 1867. For detailed accounts of these various states and colonies we refer to the articles under the proper heads.

Humboldt gives the following estimate of the entire population of America in 1823:

	Number.	Proportion.
Whites.....	13,471,000	38 per cent.
Indians.....	8,610,000	25 " "
{ Slaves, 5,000,000 } ..	6,433,000	19 " "
Negroes. { Free, 1,433,000 }	6,428,000	18 " "
Mixed races.....	34,942,000	

Bollaert made the following estimate for 1863:

	Number.	Proportion.
Whites.....	38,074,423	52 per cent.
Indians.....	11,014,710	15 " "
Negroes.....	12,122,030	17 " "
Mestizoes.....	6,031,000	
Mulattoes.....	4,937,440	16 " "
Zamboes.....	1,593,230	
	72,842,833	

What will be the number of the inhabitants of the new continent two or three centuries hence, and of what races will it consist? Setting aside the negroes, to simplify the question, and the Indians, who will gradually disappear, it is evident that the soil of America is destined to be occupied by two races, who may be designated as the Anglo-Saxon and the Spanish-Indian. In the latter the Indian blood greatly predominates, for the Creoles or pure progeny of the Spaniards probably do not constitute more than 20 per cent. of the population, while the civilized Indians may amount to 50, and the Mestizoes to 30.

The whites in the United States were in 1850.....	19,500,000
The population of British America.....	2,500,000
	22,000,000

The population of Spanish and Portuguese America, exclusive of slaves, was in round numbers.....20,000,000

The Anglo-Saxon population in America increases at 3 per cent. annually, and double its numbers in 25 years.

Its amount in 1850 was.....	22,000,000
In 1880 it was.....	50,000,000
In 1900 it will be.....	88,000,000
In 1925.....	176,000,000

A population 176,000,000 spread over the territories of the United States and Canada would only afford an average of 40 persons to each square mile, about 1-7th part of the density which England now exhibits, and could occasion no pressure. But let us suppose the rate of increase after 1925 to fall to 2 per cent., the period of doubling will then be 35 years.

In 1960 the number will be	352,000,000
In 1995 do. do.	704,000,000

Suppose the rate again to decline to 1½ per cent., which scarcely exceeds that of England and Prussia, the period of doubling will then be 50 years.

It appears that, supposing the two races to have free space for expansion, the Anglo-Saxon population in 220 years from the present time will amount to 2,816 millions, while the Spanish-Indian population will only have multiplied to 200 millions, or *one-fourteenth part* of the other. It might be shown, on probable grounds, that the new continent, if fully peopled, could support 3,600 millions. Nearly forty years ago M. de Tocqueville calculated that along the great space from the Gulf of Mexico to the Canadian lakes the whites were advancing over the wilderness at an average rate of 17 miles per annum, and that enlightened observer was powerfully impressed by the grandeur and solemnity of this deluge of men, forever swelling and flowing onward, to the west, the south, and the north, as "driven by the hand of God." Since he wrote, the rate of progress has perhaps doubled, and every year will quicken its pace. If, then, we take a glance at the state of America at any future period, say 220 years hence (A. D. 2095), we must take the ratio of increase of the two civilized races as the prime element of our calculation. We may assume that the whole continent, from Behring's Straits and Hudson's Bay to Cape Horn, will be divided between the two races in some such proportion as their rate of growth indicates—it may be 10, 15, or 20 to 1. Supposing them to maintain a separate existence, the weaker race will probably be driven, like the Welsh before the English, into the mountainous and inhospitable regions. On the other hand, it is possible, and not improbable, that the smaller population may be absorbed into the mass of the greater. The result, like other things in the womb of time, may be modified by causes yet unseen; but in whatever shape it may present itself, there is little risk in predicting that the Anglo-Saxon race is destined by its superior intelligence and energy to rule the New World from end to end. American statesmen now speak of the whole continent as the heritage of our people.

Paradoxical as the fact may appear, we are satisfied that the new continent, though less than half the size of the old, contains at least an equal quantity of useful soil and much more than an equal amount of productive power. America is indebted for this advantage to its comparatively small breadth, which brings nearly all its interior within reach of the fertilizing exhalations of the ocean. In the old continent, owing to its great extent from east to west, the central parts, deprived of moisture, are almost everywhere deserts; and a belt round the western, southern, and eastern shores, comprises nearly all that contributes to the support of man. How much fruitful land, for instance, is there in continental Asia? If we draw a line from the Gulf of Cutch (near the Indus) to the head of the Yellow Sea, we cut off India and China, with the intervening Birman empire and the southern valleys of Thibet; and this space, which comprises only about one-fifth of the surface of Asia, embraces five-sixths of its productive power. Arabia, Persia, Central Thibet, Western India, Chinese and Independent Tartary are deserts, with scattered patches of useful soil not amounting to the twentieth part of their extent. Siberia, or Northern Asia, is little better, owing to aridity and cold together. Antilia, Armenia, the Punjab, and a narrow strip along the western shores of the Pacific Ocean, north as far as the 60th parallel, compose the only valuable agricultural territory beyond India and China. Europe, which is merely the western margin of Asia, is all fruitful in the south; but on the north its fruitfulness terminates at the 60th or 62d parallel. Africa has simply a border

of useful soil round three-fourths of its sea-coast, with some detached portions of tolerably good land in its interior. Of the 31,000,000 of square miles which these three continents occupy, we cannot find, after some calculation, that the productive soil constitutes so much as one-third and of that third a part is but poor.

AMERICANISMS. [See also Art. "ENGLISH LANGUAGE" in these volumes.] Words and phrases racy of the soil. Many are purely colloquial, many are but little removed from slang; but, for all that, it is safe to say that the English language has been not only added to, but enriched, by a number of expressive phrases and names thus originated. There are also a great many so-called Americanisms which are really original Anglicisms now obsolete in the land of their birth, or to which the two countries now attach meanings essentially different. For instance, the word "guess," so much used in New England, is pure English, and was used by Chaucer, Spenser, Coleridge, and Byron. "Reckon" and "calculate," "smart" for clever, "ugly" for ill-natured, and "mad" for angry, had the same meanings in England in the seventeenth and eighteenth centuries as are now given them here. The early Puritan settlers brought with them the characteristic dialect and provincialisms of Lincolnshire and other rural English districts, and many a New England phrase of to-day still finds its counterpart in the speech of the English agriculturist.

A new country practically needs a new language; it may be content to use an old one as a base-root, but is bound to add to and largely change it. The vast non-English immigration has had some effect upon the speech of Americans, but much less than would be supposed. We have borrowed *loafer*, *boss*, and *bowyer*, from the Dutch; *ranch*, *vamosé*, and *cañon*, from the Spanish; *bayou* and *levee* from the French. But where the United States has incorporated from the latter language a few such words as *depot*, *valise*, and *bureau*, the English have assimilated hundreds. Americans do not use, although the English do, such ridiculous phrases as *the dansante*; or speak of society celebrities as *the crème de la crème*; expressions totally unknown to any French save that of Stratford-atte-Bowe. Of the coined Americanisms, most have the merit of pith and brevity. "Get," said the man with the gun, and "You bet," replied the burglar, as he quickly withdrew. An Englishman would have said, "If you don't go away I will shoot," and the thief would have answered, "All right, mister, I'm going." It must be confessed that we are somewhat lavish in our use of the harmless, necessary "fix," and that "pretty" as an adjective is misapplied. But the latter is not nearly so much out of place as the English "awfully." "Pretty strong" is bad enough, but "awfully jolly" is a great deal worse. It is true, however, that we have borrowed far too extensively from the Latin. We operate instead of work, locate instead of place, recite instead of say our lessons; and construct our residences on an eminence, instead of building houses on a hill. On the other hand, we have cars instead of railway carriages, and we wire instead of sending a telegraphic message. "Is that so?" is certainly more expressive than the inane "Really?" or "Indeed!" As for our purely native slang and Western colloquialisms, many have already forced their way into English speech. "Go-ahead," "right away," "hurry up," "posted," to "boom," "rush" it through, are all freely used in England, while the average London sport bets his "dollar" on the Derby and pays a crown piece when his nag fails to "pull it

off." Even the American "blizzard," expressive of the blinding snow and wind storm, has been forced upon the English as the only available word to characterize the storms which in the spring of 1891 overwhelmed the "tight little island."

AMERICAN LITERATURE. The following is from the pen of a distinguished Englishman, and as "a prophet is not without honor save in his own country," we give his estimate of our literature:

The literature of the United States, while still half our own, is pervaded, to a degree not easily estimated, by a foreign element. The relationship between Englishmen and Americans, making them ignorant of their mutual ignorance, operates against the soundness of their judgment on each other's work. Community of speech, which ought to be a bond of union, is often a medium of offence; for it dispenses with a study of the language, and in studying a language we learn something also of the habits and social histories which are reflected in, and serve to interpret, distinctly alien literatures. Facility of travel, making it easy to acquire first impressions, is a temptation to such hasty estimates as many of the most accomplished Americans have formed of England, and many of the most accomplished Englishmen have formed of America. The least satisfactory works of some of their foremost writers, as Mr. Hawthorne's *Old Home* and Mr. Emerson's *English Traits*, are those associated with their transatlantic experiences. But of the mistakes on both sides, ludicrous and grave, we have had perhaps the larger share. Few Americans have ever so misconceived a British statesman as we misconceived Mr. Lincoln, or gone so far astray in regard to any crisis of our history as we did in reference to the moving springs and results of their Civil War. The source of this greater ignorance lies not so much in greater indifference as in greater difficulty. England is one, compact and stable. The United States are many, vast, various, and in perpetual motion. An old country is a study, but a new country is a problem. Antiquity is brought to our firesides in the classics, till Athens and Rome

"To us are nothing novel, nothing strange."
We are more familiar with the Acropolis than with the Western Capitol—with Mt. Soracte than with the Catskills. Our scholars know more about Babylon than about Chicago. Dante immortalises for us the Middle Age; Plantagenet England is revived in Chaucer; the inner life of modern England has a voice in Tennyson and the Brownings. Where is the poet who will reveal to us "the secrets of a land," in some respects indeed like our own, but separated in other respects by differences which the distance of 3000 miles of ocean only half represents; which, starting on another basis, has developed itself with energies hitherto unknown in directions hitherto unimagined? Who will become the interpreter of a race which has in two centuries diffused itself over a continent, the resources of which are not more than half discovered, and which has to absorb within itself and harmonise the discordant elements of other races for whom the resources of the Old World are well-nigh exhausted? *Caret vate sacro*; but it does not want poetical aspirations as well as practical daring: "This land o' oun I tell ye's got to be

A better country than man ever see;
I feel my sperit swellin' with a cry
That seems to say, 'Break forth and prophesy.'
O strange New World, thet yet wast never young,
Whose youth from thee by gripin' want was wrung,
Brown foundlin' o' the woods, whose baby bed
Was prowled round by the Injun's cracklin' tread,
An' whogrew't strongthru' shifts an' wants an' pains,
Nursed by stern men with empires in their brains."

II.—CONDITIONS AND CHARACTERISTICS OF AMERICAN LITERATURE.

The number of writers who have acquired some amount of well-founded reputation in the United States is startling. The mere roll of their names would absorb a great part of the space here available for an estimate of the works which best represent them. Mr. Griswold informs us that he has in his own library more than 700 volumes of native novels and tales; his list of "remarkable men" is like Homer's catalogue of ships. Almost every Yankee town has indeed its local representatives of literature, reflecting in prose or verse the impulses and tendencies of the time. But while America has given birth to more than a fair proportion of eminent theologians, jurists, economists, and naturalists, hardly any great modern country, excepting Russia, has in the same number of years produced fewer works of general interest likely to become classical; and Bishop Berkeley's prophecy of another golden age of arts in the Empire of the West still awaits fulfillment. This fact, mainly attributable to obvious history causes, is frankly recognised by her own best authors, one of whom has confessed—"From Washington, proverbially the city of magnificent distances, through all its cities, states, and territories, ours is a country of beginnings, of projects, of designs, of expectations." The conditions under which the communities of the New World were established, and the terms on which they have hitherto existed, have been unfavorable to Art. The religious and commercial enthusiasms of the first adventurers to her shores, supplying themes for the romancers of a later age, were themselves antagonistic to romance. The spirit which tore down the aisles of St. Regulus, and was revived in England in a reaction against music, painting, and poetry, the Pilgrim Fathers bore with them in the "Mayflower," and planted across the seas. The life of the early colonists left no leisure for refinement. They had to conquer nature before admiring it, to feed and clothe before analysing themselves. The ordinary cares of existence beset them to the exclusion of its embellishments. While Dryden, Pope, and Addison were polishing stanzas and adding grace to English prose, they were felling trees, navigating rivers, and fertilising valleys. We had time, amid our wars, to form new measures, to balance canons of criticism, to discuss systems of philosophy; with them

"The need that pressed sorest
Was to vanquish the seasons, the ocean, the forest."

The struggle for independence, absorbing the whole energies of the nation, developed military genius, statesmanship, and oratory, but was hostile to what is called polite literature. The people of the United States have had to act their Iliad, and they have not had time to sing it. They have had to piece together the *disjecta membra* of various races, sects, and parties, in a *παραπολίτιν* πολίτειαν. Their genius is an unwedded Vulcan, melting down all the elements of civilisation in a gigantic furnace. An enlightened people in a new land, "where almost everyone has facilities elsewhere unknown for making his fortune," it is not to be wondered that the pursuit of wealth has been the leading impulse; nor is it perhaps to be regretted that much of their originality has been expended upon inventing machines instead of manufacturing verses, or that their religion itself has taken a practical turn. One of their own authors confesses that the "common New England life is still a lean impoverished life, in distinction from a rich and suggestive one;" but it is there alone that the speculative and artistic tendencies of recent years have found room and occasion for development. Our travel-

lers find a peculiar charm in the manly force and rough adventurous spirit of the far West, but the poetry of the pioneer is unconscious. Bret Harte, Hay, and Joaquin Miller have caught the spirit of the new and energetic West, and have embalmed in stirring lyrics the heroic age of the pioneer and the miner. The literature of the South, on the other hand, is the fruit rather of leisure and of culture than the rugged development of a stern struggle with natural forces. Some of the sweetest poetry ever written has been traced by Southern pens, and the most distinctively American writer of whom we can boast—preëminent alike in fiction and in poetry—Edgar Allan Poe, was educated in and spent the greater part of his too brief life in the South, his productions appearing almost exclusively in Southern magazines. In the higher branches of culture the South long reigned supreme, and from her soil sprang the authors of the organic law, the immortal Declaration of Independence, the State papers which have become embodied in the history of the land. Her sons, inheriting great names and placed above the need of continued literary labor for the supply of their daily needs, devoted themselves to the cultivation of oratory and the art of government, and for three-quarters of a century practically controlled the executive, the judicial, and the legislative branches of the government. The new South of to-day gives fair promise of a rapid and gratifying development of literary production distinctively American, and presenting a faithful portraiture of life and manners which we would not willingly see pass away unrecorded, and which is full of interest to American readers.

When we remember that the Romans lived under the sky of Italy, that the character of the modern Swiss is like that of the modern Dutch, we shall be on our guard against attributing too much to the influence of external nature. Another race than the Anglo-Saxon would doubtless have made another America; but we cannot avoid the belief that the climate and soil of America have had something to do in moulding the Anglo-Saxon race, in making its features approximate to those of the Red Indian, and stamping it with a new character. An electric atmosphere, and a temperature ranging at some seasons from 50° to 100° in twenty-four hours, have contributed largely to engender that restlessness which is so conspicuous "a note" of the people. A territory which seems boundless as the ocean has been a material agent in fostering an ambition unbridled by traditional restraints. When European poets and essayists write of nature, it is to contrast her permanence with the mutability of human life. We talk of the everlasting hills, the perennial fountains, the ever-recurring seasons. "Damna tamen celeres reparant coelestia lunæ—nos ubi decidimus"—In the same spirit Byron contemplates the sea and Tennyson a running stream. In America, on the other hand, it is the extent of nature that is dwelt upon the infinity of space, rather than the infinity of time, is opposed to the limited rather than to the transient existence of man. Nothing strikes a traveller in that country so much as this feature of magnitude. The rivers like rolling lakes, the lakes which are inland seas, the forests, the plains, Niagara itself, with its world of waters, owe their magnificence to their immensity; and by a transference, not unnatural although fallacious, the Americans generally have modelled their ideas of art after the same standard of size. Their wars, their hotels, their language, are pitched on the huge scale of their distances. "Orphaned of the solemn inspiration of antiquity," they gain in surface what they have lost in age; in hope, what they have lost in memory.

"—That untravelled world whose margin fades
For ever and for ever when: they move."

is all their own; and they have the arena and the expectations of a continent to set against the culture and the ancestral voices of a thousand years. Where Englishmen remember, Americans anticipate. In thought and action they are ever rushing into empty spaces. Except in a few of the older States, a family mansion is rarely rooted to the same town or district; and the tie which unites one generation with another being easily broken, the want of continuity in life breeds a want of continuity in ideas. The American mind delights in speculative and practical, social and political experiments, as Shakerism, Mormonism, Pantagamy; and a host of authors, from Emerson to Walt Whitman, have tried to glorify every mode of human life from the transcendental to the brutish. The habit of instability, fostered by the rapid vicissitudes of their commercial life and the melting of one class into another, drifts away all landmarks but that of a temporary public opinion; and where there is little time for verification and the study of details, men satisfy their curiosity with crude generalisations. The great literary fault of the Americans thus comes to be *impatience*. The majority of them have never learnt that "raw haste is half-sister to delay;" that "works done least rapidly, art most cherishes." The makeshifts which were at first a necessity with the Northern settlers have grown into a custom. They adopt ten half measures instead of one whole one; and, beginning bravely, like the grandiloquent preambles to their Constitutions, end sometimes in the sublime, sometimes in the ridiculous.

Many of the artistic as well as many of the social peculiarities of the United States may doubtless be traced to their form of government. After the most obvious wants of life are provided for, Democracy stimulates the production of literature. When the hereditary privileges of rank have ceased to be recognised, the utility, if not the beauty, of knowledge becomes conspicuous. The intellectual world is spurred into activity: there is a race in which the prize is to the swift. Everyone tries to draw the eyes of others by innumerable imperfect efforts with a large insignificant sum total. Art is abundant and inferior: whitewashed wood and brick pass for marble, and rhythmical spasms for poetry. It is acknowledged that the prevailing defect of Aristocratic literatures is formality; they are apt to be precise and restricted. A Democratic literature runs the risk of lawlessness, inaccuracy, and irreverence. From both these extremes the Athenian, the Florentine, and the Elizabethan classes were preserved by the artistic inspirations of a flexible tradition. The one is exemplified in the so-called Augustan ages of letters, in the France of Louis XIV. and the England of Queen Anne, when men of genius, caring more to perfect their style than to establish the truth, more to captivate the taste than to stir the passions, moved with clipt wings in a charmed circle of thought. The other has its best illustration in the leaders of our own romantic schools, but its most conspicuous development in America; a country which is not only democratic but youthful without the modesty of youth, unmelled by the past and untrammelled by authority, where the spirit of adventure is unrestrained by feelings of personal loyalty—where order and regularity of all kinds are apt to be misnamed subservience—where vehemence, vigor, and wit are common, good taste, profundity, and imagination rare;—a country whose untamed material infects the people, and diverts them from the task of civilisation to the desire of conquest.

American literature is cramped on another side by the spirit of imitation. It has been in great measure an offshoot or prolongation of our own. As English sculptors study at Rome and Naples, the most prominent Western artists in every department have almost

invariably inaugurated their careers by travelling in Europe, and writing descriptions of the foreign lands where they have found their richest intellectual culture. They have sought the sources, the themes, the rules, and the sanction of their art in the Old World, and their highest ambition, like that of all colonists, has hitherto been to receive a favorable verdict, not from the country of their birth, but from that of their ancestors. Even Franklin—in some respects an American of the Americans—was in philosophy a practical disciple of Locke, as Jefferson was of the French Revolution. "The literary genius of Great Britain," says De Tocqueville, "still darts its rays into the recesses of the West. . . . The small number of men who write are English in substance, and still more in form." Of the great number of men who have written in America since the date of this criticism, only a few have written much to confute it. Washington Irving, who, in the course of four distinct visits, spent much of his life in Europe, only escapes from the influence of Addison in his *Knickerbocker* and Dutch sketches. On land at least, Cooper—though in many respects an original writer—everywhere remembers Scott. As in the works of the Scotch novelist, the semi-barbarous feudal spirit is represented in conflict with modern law, in those of the American the enterprise of New England is struggling against the ruggedness of nature and a savage life. The writers of the last thirty years have been making strenuous, sometimes spasmodic, efforts after originality, but they are still affected by transatlantic associations. In the style of Mr. Motley we cannot help observing the stamp of Carlyle. The Transcendental movement begun by Emerson is admitted to have derived its first impulse from *Sartor Resartus*; and among the eccentricities of its leading followers none is more remarkable than their mania for German and Oriental quotations. The tyranny which five centuries' load of classics in the same tongue exercises over the mind of a nation not yet a century old, is very much strengthened by the non-existence of an international copyright, which leads to the intellectual market being glutted with stolen goods. As long as a publisher in Boston or New York can republish a good book written in Edinburgh or London without paying for it, he is likely to prefer an undertaking which involves no risk and comparatively no outlay, to another which involves both; that is, the republication of the English to the first publication of an American book; for the English book has already attained its reputation, and its popularity in America is secured, while the American book, for the copyright of which he has to pay, has, except in the case of a few authors, still to win its spurs. If the people of the United States had spoken a language of their own, it is probable they would have gained in originality; as it is, they are only now beginning to sign their intellectual declaration of independence,—a fact confessed among the latest words of their own greatest prose artist:—"Bred in English habits of thought as most of us are, we have not yet modified our instincts to the necessities of our new modes of life. Our philosophers have not yet taught us what is best, nor have our poets sung to us what is most beautiful in the kind of life that we must lead, and therefore we still read the old English wisdom, and harp upon the ancient strings."

III.—EARLIER AMERICAN LITERATURE.

We may trace the influence of the foregoing controlling facts or tendencies, subject to various phases of personal power through the three great periods under which Anglo-American history obviously falls:—The Colonial, the Revolutionary, and that of the 19th Century.

1. *The Colonial Period.*—Little of interest in the world of letters has come down to us from the 17th century in the West. Sandy's *Ovid*, translated on the banks of the James River, dedicated to Charles I., and published 1626, is worthy of note as the first contribution to English literature from America. About the same date the Welsh Puritan Vaughn sent home his *Golden Fleece* from Newfoundland, and Captain Smith gave to the world his descriptions of Virginia. But the earliest verse that has a real claim to be regarded as American is a doggerel list, by an anonymous author, of New England's annoyances, which, if we remember the date—a generation after Spenser had celebrated "the Indian Peru" in his *Faery Queen*—will confirm our view of the backwoodsman's want of leisure for "polishing his stanza":—

"The place where we live is a wilderness wood,
Where grass is much wanting that's fruitful and good.

If fresh meat be wanting to fill up our dish,
We have carrots and pumpkins, and turnips and fish;
We have pumpkins at morning and pumpkins at noon,
If it was not for pumpkins we should be undone."

A little later we have a Puritan version of the Psalms, the worst of many bad; and about 1650 the poems of Anne Bradstreet and Benjamin Thomson, worthy of mention, but scarcely readable. In prose are relics of the sermons and controversies of Roger Williams and John Cotton and Eliot, the apostle of the Indians, with the ponderous *Magnalia* and witch denunciations of Cotton Mather. The main literary event of the century was the foundation (1636) of Harvard University. That of Yale followed at a long interval, and subsequently those of New Jersey, Rhode Island, and Princeton. In all new countries industrial and commercial interests are at first the strongest. The febrile activity produced by fear of a sterile future leaves little room for speculative imagination. But in the New World, colonised in part by adventurers, in part by religious refugees and enthusiasts, another influence was from the first at work. When her solitudes began to give place to cities, the brains of her people were expended on the farm or the exchange with a zeal materially modified by the spirit and formulæ of the faith which led the founders of the Northern States across the sea, and continued to infuse a religious element into their enterprises. This element, which elevated the settlers of New England above ordinary emigrants, adding to their strength and giving a faster dye to their morality, was yet, in its original form, no more favorable to freedom or variety of thought than the industrialism by which it was surrounded. But it begat and fostered the Puritan theological literature which was concentrated in the massive yet incisive treatises and discussions of Jonathan Edwards of Connecticut—(1703-1758)—who, if not, as asserted by American panegyrists, "the first man of the world during the second quarter of the 18th century," was yet, by the clear vigor of his thought and the force of its expression, one of the foremost figures of that era. An estimate of his rank as a theologian belongs to a distinct branch of the history of American literature. It is enough here to refer to the testimony of all competent judges as to the singular lucidity of his style, and to that of his contemporaries as to the fervor of his eloquence and the modest simplicity of his life. Passages of his occasional writings, as the description of his future wife, evince a "sweetness and light" of temper not always associated with the views of which he was and remains the most salient English advocate. A slightly junior contemporary of Edwards, the exponent *κατ' ἐξοχήν* of the other—that is, the secular side of early American life—was destined to see the end of one

and play a prominent part in opening another era of his country's history. Benjamin Franklin, as long as Utilitarian philosophy endures, will be a name to conjure with. It is *clarum et venerabile*, though its owner was endowed with as little as possible for a great man of the "faculty divine." Franklin's autobiography, the details of which need not find place here, is as romantic as the life of an unromantic person can be. The incidents of the young candle-moulder—the printer's apprentice—the ballad-monger wisely discouraged by the wise paternal criticism, "Verse-makers are generally beggars"—the runaway, eating rolls on the Philadelphia street—his struggling life in London with Ralph of the *Dunciad*—his return, "correcting the erratum" of his infidelities by marriage with his old Pennsylvania friend—his success as a printer, economist, statesman, and diplomatist—his triumphs in natural and political philosophy, clenched in Turgot's line, adapted from Manilius—

"Eripuit cælo fulmen, sceptrumque tyrannis"—

his examination before the House of Commons, resulting in the repeal of the Stamp Act, when Lord Chatham spoke of him as one who was "an honor not to England only, but to human nature"—his signature of the Declaration of Independence—his ministry in France and popular triumph with Voltaire, who said, "Je n'ai pu résister au désir de parler un moment la langue de Franklin"—the acclamations of shouting multitudes on his return home—Mirabeau's announcement of his death (in 1790, in his eighty-fourth year) to the assembly—"the genius which has freed America, and poured a flood of light over Europe, has returned to the bosom of the divinity"—are elementary facts for schoolboy history. They are the records of the successive stages of the greatest success achieved in modern times by the genius of common-sense, integrity, and industry indomitable. Franklin's experiments and physical discoveries form a chapter in the history of science; but half of his fame even in this field is due to the precision and clearness of the manner in which they are announced. "The most profound observations," says Lord Jeffrey, "are suggested by him as if they were the most obvious and natural way of accounting for phenomena." The same literary merit characterises the financial pamphlets and treatises which first brought him into celebrity. Both are marked by the same spirit,—the love of the useful, which was his passion through life. Franklin follows Bacon to an extreme opposed to that of the Platonists, in decrying abstractions. Archytas is said to have apologised for inventing the arch. Franklin is ashamed to have wasted time over pure mathematics in his "magical squares." His aim is everywhere to bring down philosophy, like the lightning, from heaven and earth, *illustrans commoda vita*. His ethics—those of Confucius or the Seven Sages, modified by the experience and the circumstances of a later age—are embodied in the most famous of popular annuals, *Poor Richard's Almanack*, in which for twenty-six years he taught his readers (rising to the number of 10,000) "the way to be healthy and wealthy and wise," by following simple utilitarian rules, set forth in plain incisive prose and rhyme, rendered attractive by a vein of quaint humor and the homely illustrations always acceptable to his countrymen. The same train of thought appears in the "Whistle," among the letters from Passy, where his persistent deification of thrift appears side by side with graceful compliments to Mesdames Helvetius and Brillouin, records of the aftermath of sentiment that often marks a green old age. Franklin remains the most practical of philosophers in perhaps the most practical of nations.

2. *The Revolutionary Period.*—It has often been remarked that periods of political national crises are more

favorable to the preparation than to the actual production of literature. Wordsworth's assertion, that poetry is the outcome of emotion recollected in tranquillity, applies with slight modification also to artistic prose. The demands for instant action on the reflective powers sink into abeyance, but a stormy season is the seed-time of a later harvest. There is only one exercise of the imagination that it directly stimulates—that of the orator; and the conditions of his success, save in a few instances, make a drain on his posthumous reputation. In reading even the greatest speeches of the past, divested of the living present which gave them color and force, we find it difficult to account for the effect which they are known to have produced. They are the ashes or the fossils of genius. Little that is of permanent literary value is left us of the harangues that were the trumpet-calls of patriotism during the American Revolutionary War. The triumphs of Patrick Henry, who "wielded at will that young democracy," are commemorated in the judicious biography of Wirt, but few of his orations are accurately preserved; and of the speeches of James Otis, which were compared to "flames of fire," we have merely a tradition. His pamphlet (1762), entitled *A Vindication of the conduct of the House of Representatives*, is considered to contain the germ of the Declaration of Independence. Among the considerable efforts of eloquence, those of Fisher Ames are worthy of note as being directed in great measure against the excesses of democracy. The master-minds of the era were the statesmen and jurists, who fought for the free soil, sunk the deep foundations, and reared the superstructure of the new Commonwealth. The history of America is a distinct theme. It must suffice here to mention, as claiming recognition in the field of letters, Washington himself, in his clear and incisive though seldom highly-polished correspondence; his biographer John Marshall, chief justice of the supreme court from 1801 to 1835, one of the early pilots of the state, who left behind him a noble and stainless name, and laid down the first principles of that international code afterwards elaborated by Wheaton, Madison, John Jay, the elder Adams, and Alexander Hamilton, during the war Washington's "most confidential aid," afterwards the presiding genius of the movement represented by the *Federalist*, the organ of the anti-democratic party. To this he contributed three-fourths of the material, marked, as are all his papers and speeches, by originality of thought, breadth of view, and purity of style. As secretary of the treasury, he became perhaps the greatest of financiers. The general judgment of his countrymen acquiesces in the terms of the tribute paid to his memory by Guizot. "He must be classed among the men who have best known the vital principles and fundamental conditions of a government worthy of its name and mission." Of Hamilton's numerous historical sketches, the most celebrated is his letter to Colonel Laurens giving an account of the fate of Major André, in which refinement of feeling and inflexible impartiality of view are alike conspicuous. The great and unhappily the bitter antagonist of the Federalists is one of the most conspicuous figures in the history of American thought. Thomas Jefferson (1743-1826), President from 1801 to 1809, is the representative in chief of the revolutionary spirit of his age and country. While his rival compeers stood firmly on the defensive against the encroachments of an arbitrary government, his desire was, in politics as in speculation generally, to break with the past. Inspired with patriotic zeal by Patrick Henry's denunciations of the Stamp Act, he came forward prominently in 1769 as a member of the Colonial Assembly of Virginia. In 1776 the main part of the responsibility of drawing up the Declaration of Inde-

pendence fell upon him. In 1784 he was appointed minister of the congress in Paris, where he spent the greater part of six years, and brought back an admiration for those phases of the French Revolution from which the more temperate judgments of Hamilton and Fisher Ames had recoiled. He threw himself heart and soul into the arms of the Democratic party, and in the constitutional struggle that ensued his keener sense of the direction in which popular sympathies were tending, with the weight of his vast physical energies, gave him the ascendancy over the wider knowledge and more far-seeing intellects of his adversaries. Jefferson might be termed the Danton of the West, but his forte lay not so much in oratory as in political management and incisive vivacity. More perhaps than any other great statesman of his age, he aspired to be an author, to which title the best passages in his *Notes on Virginia*, his *Autobiography*, and *Correspondence*, give him a fair claim. His descriptions of scenery in the first are always pleasing and generally graphic. His sketches of Continental society are lively, and his occasional flights of fancy, as the dialogue between the head and heart, at least ingenious. His religion and ethics were those of his friend Tom Paine and the *Encyclopédie*.

English philology and literature were during this period represented by the famous Lindley Murray and Noah Webster (1788-1805), the author of the best dictionary of our language that has appeared since Johnson's. In natural science, the two Bertrams; Alexander Wilson, the ornithologist; and Audubon, the literary glory of Louisiana, whose descriptions of animate nature rival those of Buffon, are illustrious names.

IV.—THE LITERATURE OF THE NINETEENTH CENTURY.

Prose Writings.

1. In a rapid estimate of the literature of this prolific age we can only signalise its contributions to the several branches of physical and mental science. The United States have during the last two generations been justly proud of the names of Morton and Schoolcraft in ethnology, of Bowditch in mathematics, of Sullivan and Dana in chemistry and mineralogy. Their classical scholarship, which hardly competes with that of England, has yet been fairly maintained by Everett, Felton, Woolsey, Anthon, and Robinson. Dr. Marsh is an accomplished English scholar, while Professor Whitney is a learned and accurate philologist, whose researches in Sanscrit are well known and appreciated by European Orientalists. The metaphysical schools of Locke and Reid are nowhere better represented than in America by Dr. Bowen and Dr. N. Porter. The place of Marshall as a jurist has been worthily filled by Chief-Justice Kent and Judge Story; the latter of whom ranks, by virtue of his essay on classical studies and his graceful descriptions of natural scenery, among the most accomplished of the numerous professional men who have in the New World devoted their leisure hours to lighter literature.

The inhabitants of the United States have always been noted for remarkable fluency, sometimes a superfluency, of speech. The early years of the century were illustrated by the fiery zeal of Rudolph and the practical force and occasional impassioned eloquence of Henry Clay. The great political controversies inherited from the preceding age found their most conspicuous popular exponents in two leading minds laying claim to diverse kinds of greatness, and destined to be in almost incessant antagonism. John C. Calhoun, the most illustrious representative of the Southern States, of whose rights, real or imaginary, he was during his life the foremost champion, was by education and choice a professional statesman. Secretary of War in 1817, and Vice-Presi-

dent of the Commonwealth in 1824, he resigned the latter office on occasion of the dispute about the tariff law of that year, to become a leader of the Opposition; and in vindicating the attitude of South Carolina was the first to lay the strands of the future Secession war. The most accomplished modern apologist for slavery, it is probable that he only hastened the conflict between opposing principles which was sooner or later inevitable. Calhoun's eloquence, as attested by his auditors and the numerous speeches and papers preserved in the six volumes of his published works, was notable for its earnestness and gravity, the terse polish of its manner, for philosophic generalisations and analytical dialectic. His prevailing sincerity and candor have made his memory respected by those farthest removed from him in sentiment and opinion. Daniel Webster, on the whole the grandest orator of the New World, was during the greater part of his career the champion of Massachusetts and the asserter of her policy. His defence of that State in the Senate (1830) against General Hayne of Carolina, and his oratorical duel with Calhoun (1838), resulting in the temporary overthrow of the doctrine of nullification, are among the most remarkable triumphs of debate in history. Some of his pleadings on criminal trials have an almost terrible power. But his literary genius and richness of illustration found freer scope in his famous appeal for the Greeks in 1823, his great speech (1820) on the second centennial anniversary of the landing of the Pilgrims, or his address (1825) on laying the corner-stone of Bunker Hill monument. Webster's eloquence, everywhere solid, massive, and on great occasions glowing with a lurid light, is not the mere record of half-forgotten strifes; it is "vital in every part," and belongs to the permanent literature of his country, in whose political arena he was during his life perhaps the most powerful actor. The art of making commemorative speeches, technically called "orations," has been cultivated in North America to excess. The great master in this species of composition was Edward Everett, distinguished by his early association with Lord Byron in Greece, the high dignities—governor of Massachusetts, minister to the court of St. James's, and president of Harvard—to which he attained, and by the variety of his accomplishments. Mr. Everett was for ten years a useful member of Congress. In his literary work he displayed an almost fatal fluency, having contributed to the "North American Review," of which he was for some time editor, upwards of a hundred articles in the space of a few years. These articles are inevitably of unequal merit, but they everywhere evince the ripe scholarship of a highly cultivated mind. The volume by which he is best remembered—twenty-seven *Orations*—published in 1836, is marked by the same characteristics. Discoursing on a wide range of subjects—among which the refrains are America and Greece, the "Mayflower," the Progress of Discovery, Patriotism, Reform, the Republic, Concord, Lexington, and the inevitable Bunker Hill—these speeches are always able, but seldom inspiring: carefully elaborated and richly adorned, they are the production of the first of rhetoricians rather than a genuine orator.

V.—SUMMARY.

The critics of one nation must, to a certain extent, regard the works of another from an outside point of view. Few are able to divest themselves wholly of the influence of local standards; and this is pre-eminently the case when the early efforts of a young country are submitted to the judgment of an older country, strong in its prescriptive rights, and intolerant of changes the drifts of which it is unable or unwilling to appreciate.

English critics are apt to bear down on the writers and thinkers of the New World with a sort of aristocratic hauteur; they are perpetually reminding them of their immaturity and their disregard of the golden mean. Americans, on the other hand, are hard to please. Ordinary men among them are as sensitive to foreign, and above all to British, censure, as the *irritable genus* of other lands. Mr. Emerson is permitted to impress home truths on his countrymen, as "Your American eagle is very well; but beware of the American peacock." Such remarks are not permitted to Englishmen; if they point to any flaws in transatlantic manners or ways of thinking with an effort after politeness, it is "the good-natured cynicism of well-to-do age;" if they commend transatlantic institutions or achievements, it is, according to Mr. Lowell, "with that pleasant European air of self-compliment in condescending to be pleased by American merit which we find so conciliating." Now that the United States have reached their full majority, it is time that England should cease to assume the attitude of their guardian, and time that they should cease to be on the alert to resent the assumption. Foremost among the more attractive features of transatlantic literature is its *freshness*. The authority which is the guide of old nations constantly threatens to become tyrannical: they wear their traditions like a chain; and, in the canonisation of laws of taste, the creative powers are depressed. Even in England we write under fixed conditions; with the fear of critics before our eyes, we are all bound to cast our ideas into similar moulds, and the name of "free-thinker" has grown into a term of reproach. Bunyan's *Pilgrim's Progress* is perhaps the last English book written without a thought of being reviewed. There is a gain in the habit of self-restraint fostered by this state of things; but there is a loss in the consequent lack of spontaneity; and we may learn something from a literature which is ever ready for adventures. In America the love of uniformity gives place to impetuous impulses; the most extreme sentiments are made audible, the most noxious "have their day, and cease to be;" and truth being left to vindicate itself, the overthrow of error, though more gradual, may at last prove more complete. A New England poet can write with confidence of his country as the land

"Where no one suffers loss or bleeds
For thoughts that men call heresies."

Another feature of American literature is its *comprehensiveness*: what it has lost in depth it has gained in breadth. Addressing a vast audience, it appeals to universal sympathies. In the Northern States, where comparatively few have leisure to write well, almost every man, woman, and child can read and does read. Books are to be found in every log-hut, and public questions are discussed by every scavenger. During the war, when the Lowell factory girls were writing verses, the "Biglow Papers" were being recited in every smithy. The consequence is, that (setting aside the newspapers) there is little that is sectional in the popular religion or literature; it exalts and despises no class, and almost wholly ignores the lines that in other countries divide the upper ten thousand and the lower ten million. Where manners make men the people are proud of their peerage, but they blush for their boors. In the New World there are no "Grand Seigniors," and no human vegetables; and if there are fewer giants, there are also fewer mannikins. American poets recognize no essential distinction between the "Village Blacksmith" and the "caste of Vere de Vere." Burns speaks for the one; Byron and Tennyson for the other; Longfellow, to the extent of his genius, for both. The same spirit which glorifies labor denounces every form of despotism but

that of the multitude. American slavery, being an anachronism based on the antipathies of race, was worse than Athenian slavery. But there is no song of an Athenian slave. When the ancients were unjust to their inferiors, they were so without moral disquietude: the lie had got into the soul. Christianity, which substituted the word "brother" for "barbarian," first gave meaning to the word "humanity." But the feudalism of the Middle Ages long contended successfully against the higher precepts of the church: the teaching of Froissart held its ground against that of Langland. The hero-worship of our greatest living author is apt to degenerate into a reassertion of the feudal spirit. The aspirations of our descendants in the West point, on the other hand, to a freedom which is in danger of being corrupted by licence. But if the vulgarism of demagogic excess is restrained and overcome by the good taste and culture of her nobler minds, we may anticipate for the literature of America, under the mellowing influences of time, an illustrious future.

AMERICUS, a considerable town of Sumter County, Ga. Its chief trade is in cotton and agricultural produce. The town is the center of a rich agricultural country, and the amount of business done in the distribution of necessities and the collection and shipment of country produce is considerable. It has banks, schools, churches, railroad and telegraph connections, and is rapidly putting on the appearance of a progressive city. It has of late been especially thriving, and its population in 1900 was 7,674.

AMERIGO VESPUCCI. See **VESPUCCI**.

AMERSFOORT, a town of Holland, in the province of Utrecht, situated 12 miles E.N.E. of the city of that name, on the Eem, which here is navigable. Population, 13,200.

AMERSHAM, or **AGMONDESHAM**, an old market town in Buckinghamshire, pleasantly situated in the valley of the Misbourn, a small tributary of the Colne, 32 miles from Buckingham and 26 from London. Population of parish about 4,210.

AMES, FISHER, an eminent American statesman and political writer, son of Nathaniel Ames, a physician, was born at Dedham, in Massachusetts, on 9th April 1758. He studied at Harvard college, where he graduated in 1774. After practising the law for some little time, he abandoned that profession for the more congenial pursuit of politics, and in 1788 became a member of the Massachusetts convention for ratifying the constitution. He died on the 4th July, 1808.

AMES, JOSEPH, author of a valuable work on the progress of printing in England, called *Typographical Antiquities* (1749), which is often quoted by bibliographers. He was born in 1689, and died in 1759.

AMES, WILLIAM, D.D. He was born at Ipswich, Suffolk, in 1576. He received an excellent education at the grammar school of Ipswich; and proceeded next to the university of Cambridge, where he was entered at Christ's college. From the outset, as to the latest, he was an omnivorous student. Entering half-carelessly into the church where the great master William Perkins was the preacher, he was, under the sermon, roused and alarmed in such fashion as was not rare under so burning and intense an orator as Perkins. Like another Nicodemus he visited the venerable preacher, and was taught and comforted so as never through life to forget his interviews with the "old man eloquent." Perkins having died at a ripe old age, was succeeded by one of kindred intellect and fervor, Paul Bayne, and his friendship also was gained by Ames. Nonconformity, admittedly in lesser things, was regarded as excluding Ames from the Church of England. He went to Holland, where he married, and succeeded to the place of his

father-in-law. It was at this time he began his controversy with Episcopius, who, in attacking the *Coronis*, railed against the author as having been "a disturber of the public peace in his native country, so that the English magistrates had banished him thence; and now, by his late printed *Coronis*, he was raising new disturbances in the peaceable Netherlands." It was a miserable libel. Mr. Goodyear being present in the lecture-room when Episcopius vented his malice, there and then rebutted his charge against his absent friend. None the less did the controversy proceed. Ultimately Ames reduced the Remonstrants to silence. At Rotterdam, whither he had removed, he drew all hearts to him by his eloquence and his irrepressible activity as a pastor. Home-controversy engaged him again, and he prepared his *Fresh Suit against Ceremonies*. He did not long survive his removal to Rotterdam. Having caught a cold from a flood which drenched his house, he died in November 1633, in his fifty-seventh year.

AMESBURY, a city of Essex county, Mass., is situated on the Merrimac river, in Amesbury township, thirty-six miles north of Boston. In the summer of 1886 a part of the village of Salisbury was annexed to Amesbury, materially adding to its population and importance. The city has direct communication with Boston and neighboring cities by the Boston and Maine railroad, and is extensively engaged in mercantile and manufacturing enterprises. Among its productions are carriages, horse-cars, bicycles, vehicle equipments, including bodies, wheels, hubs, spokes, etc., sleighs, machinery, wood and tile flooring, flour and lumber. The city contains three banks, two weekly papers, ten churches, schools and academies, a large number of stores and public buildings. Population (1900), 9,473.

AMESBURY, an old town in Wiltshire, on the Avon, 8 miles north of Salisbury, and 78 west of London.

AMETHYST, properly, is only a variety of quartz or rock-crystal distinguished by its fine violet-blue or purple color. This tint seems to be caused by a minute mixture of the peroxide either of iron or of manganese, and is lost when the stone is exposed to the action of fire. It then changes through yellow and green to colorless; and in this condition is often sold for the aquamarine or topaz. Amethyst is generally found in thick columnar masses, of short hexagonal prisms terminating in pyramids. There were fine ones made in France about the year 1690, which even imposed on connoisseurs, but with the decrease in price there is now less danger of such deceptions.

AMHERST, a district and city within the Tenasserim division of British Burmah, and within the jurisdiction of the chief commissioner of that province. The District forms a narrow strip of land between the Indian Ocean and the mountains which separate it from the independent kingdom of Siam. Pop., 301,086.

AMHERST TOWN, situated in the district of the same name, about thirty miles south of Maulmain. It was founded by the English in 1826 on the restoration of the town of Martaban to the Burmese, and named in compliment to the governor-general of India, who projected it. Population about 3,000.

AMHERST, Hampshire county, Massachusetts. It is a picturesque town intersected by two branches of the Connecticut river. Its water power is utilized for manufacturing of machinery, edge tools, cotton goods, paper, etc.; but it is principally known as the seat of Amherst College, a valuable unsectarian institution founded in 1821, with productive funds amounting to \$2,000,000, a student attendance of over 400, and a faculty numbering 36 instructors. There is a large farm for experiment attached to the school, esteemed one of the best in America. Population of town (1900), 5,028.

AMHERST, EARL (WILLIAM PITT AMHERST), born in 1773, was the nephew of Jeffery Amherst, who, for his services in America, where he was commander-in-chief at the time of the conquest of Canada, was raised to the peerage as Baron Amherst in 1776. The patent of nobility was renewed in 1788 with remainder to the subject of this notice, who succeeded to the title in 1797. In 1816 he was sent as ambassador extraordinary to the court of China, with the view of establishing more satisfactory commercial relations between that country and Great Britain. In 1823 he became governor-general of India, and in 1826 was made an earl. On his return to England he lived in retirement till his death in March, 1857.

AMHURST, NICHOLAS, an English poet and political writer of the eighteenth century, was born at Marden in Kent, and entered (1716) at St. John's College, Oxford, from which he was expelled, ostensibly for libertinism and irregular conduct, but really, according to his own statement, on account of the liberality of his opinions. Amhurst's party made no provision for him, however, on their accession to power, and their neglect is supposed to have hastened his death, which occurred at Twickenham on April 27, 1742.

AMIANTHUS, the best known and most beautiful of the asbestos class of substances. See **ASBESTOS**.

AMICE, a flowing cloak formerly worn by priests and pilgrims. Also, a strip of fine linen, with a piece of embroidered cloth sewn upon it, worn upon the shoulder by Catholic priests in the service of the mass.

AMICI, GIOVANNI BATTISTA, a celebrated designer and constructor of optical instruments, was born at Modena in 1784. After holding for some time a professorship of mathematics in Modena, he was in 1831 appointed inspector-general of studies in the duchy. A few years later he was entrusted with the charge of the observatory at Florence, where he also delivered lectures as professor of mathematics at the museum of natural history. He died in April, 1863.

AMIEL, HENRY FREDERIC, born at Geneva, Switzerland, in 1821; held professorial chairs in the University of Geneva for many years, and died in 1881.

AMIENS, an ancient city of France, capital of the department of Somme, and formerly of the old province of Picardy, situated on the Somme, about forty miles from its mouth, and seventy-one north of Paris. It was once a place of great strength, and still possesses a citadel, but the ramparts which surrounded it have been replaced by beautiful boulevards. It has many important manufactures, the chief being cotton velvets, kerseymeres, woolen and linen cloths, flax, beetroot sugar, soap, leather, and paper. Amiens occupies the site of the ancient *Samarobriua*, capital of the *Ambiani*, from whom it probably derives his name. After the dissolution of the empire of the west it repeatedly changed owners, becoming for the first time a dependency of the French crown in 1185, when Philip of Alsace ceded it to Philip Augustus; and since that date it has more than once passed out of the power of the French kings. Peter the Hermit was born at Amiens about 1050. Population

AMIOT, or AMYOT, PERE JOSEPH, a learned Jesuit missionary to China, was born at Toulon in 1718. In 1750 he arrived, along with two others of his order, at Macao, from which he removed to Peking in the autumn of the following year. His *Dictionnaire Tartaromanchou-Français* (Paris, 1789), was a work of great value. Amiot died in 1794.

AMLWCH, a town of Anglesey, North Wales, situated on a rising ground on the north coast of the island, about fifteen miles from Beaumaris. Population about 4,000.

AMMAN, JOHANN CONRAD, a physician, and one of the earliest writers on the instruction of deaf and dumb, was born at Schaffhausen, in Switzerland, in 1669. In 1687 he graduated at Basle, and commenced the practice of his profession at Amsterdam, to which he had to flee on account of his religious views. He first called the attention of the public to his method of training the deaf and dumb in a paper which was inserted in the *Philosophical Transactions*, and which appeared in a separate form in the year 1692, under the title *Surdus Loquens*. The edition of Cælius Aurelianus, which was undertaken by the Wetsteins in 1709, and still ranks as one of the best editions of that author, was superintended by Amman. He died about 1730.

AMMAN, JOST, an artist celebrated chiefly for his engravings on wood, was born at Zurich in June 1539. Of his personal history little is known beyond the fact that he removed in 1560 to Nuremberg, where he continued to reside until his death in March 1591. His productiveness was very remarkable, as may be gathered from the statement of one of his pupils, that the drawings he made during a period of four years would have filled a hay waggon. Paintings in oil and on glass are attributed to him, but no specimen of these is known to exist.

AMMAN, PAUL, a physician and botanist, was born at Breslau on the 30th August 1634. In 1662 he received the degree of doctor of physic from the university of Leipsic, and in 1664 was admitted a member of the society *Nature Curiosorum*, under the name of *Dryander*. He died on the 4th February 1691.

AMMANATI, BARTOLOMEO, a celebrated Florentine architect and sculptor, was born in 1511, and died in 1592. He studied under Bandinelli and Sansovius, and closely imitated the style of Michael Angelo. He was more distinguished in architecture than in sculpture. Ammanati's wife, daughter of Giov. Antonio Battiferri, an elegant and accomplished woman, published a volume of poems of considerable merit.

AMMIANUS, MARCELLINUS, a Roman historian of the 4th century, was born in the city of Antioch, in Syria. In his youth he was enrolled among the *protectores domestici*, or household guards, which proves him to have been of noble birth. In the year 350 he entered the service of Constantius, the emperor of the East, and, under the command of Ursicinus, a general of the horse, he served during several expeditions. Gibbon appears to give a correct estimate when he says that Ammianus is "an accurate and faithful guide, who composed the history of his own times without indulging the prejudices and passions which usually affect the mind of a contemporary." From the respectful manner in which he speaks of pagan deities, and of the advantage of heathen auguries in foretelling future events, it is evident that Ammianus was a heathen. The work of Ammianus has passed through several editions, of which the best are the Leyden edition of 1693, by Gronovius, and those of Leipsic, published in 1773 and 1808.

AMMIRATO, SCIPIO, an Italian historian, born at Lecce, in the kingdom of Naples, on the 27th September 1531. In 1569 he went to Florence, where he was fortunate in securing the patronage and support of Duke Cosmo I. It was at the suggestion of this prince that he wrote the work by which he is best known, his *Istorie Fiorentine* (1600). In 1595 he was made a canon of the cathedral of Florence. He died in 1601.

AMMON, the name of an Egyptian deity, called by the ancient Egyptians *Amen* or *Amun*, and one of the chief gods of the country. His name meant the hidden or concealed god, and in this respect was analogous to *Nepi* or *Apis*, which conveyed the same idea. He was

the local deity of Thebes or Diospolis, and supposed by the Greeks to be the same as Zeus or Jupiter. His type was that of a man wearing on his head the red crown *teshu*, emblem of dominion over the lower world or hemisphere, surmounted by the sun's disc to indicate his solar nature, flanked by two tail feathers of a hawk, also symbolical of his relation to the gods of light. Ammon was not one of the oldest deities of Egypt, for his form and name do not appear till the eleventh or Diospolitan dynasty, when the kings of that line assumed his name, and built a sanctuary to him at Medinat Habu. From this period the monarchs of Thebes introduced his name into their titles, and the worship of Amen became the predominant one of ancient Egypt; and the embellishment of his shrine and enrichment of his treasury were the chief objects of the policy of the Pharaohs. Victory and conquest were the chief gifts he offered to his adorers; and he is often seen leading up the conquered nations of the north and south to the monarchs whom he endows with power and victory. In this character Amen is often represented holding the Egyptian scimitar *khepsh*. In his celestial character his flesh was colored blue, that of the heaven. He is said to have been called on some monuments the son of Hapimaa (or the Nile, but in the hymns addressed to him the title of self-engendered is applied to him, and he was one of the self-existent deities. His principal titles are—lord of the heaven, king of the gods, substance of the world, and resident on the thrones of the world, eternal ruler,—appellatives of his celestial and terrestrial functions. He was also lord of heaven and earth, streams and hills, and a demiurgos, the creator of beings. The hymns addressed to him designate him as the sole or only god, in terms applicable to one god who alone exists, who moulds and governs the world. At one time an attempt was made to identify him with the solar orb. Considered as the active, intelligent and pervading spirit of the universe, he transfuses the breath of life into the nostrils of kings and other persons. On the conquest of Egypt, Alexander the Great called himself the son of Ammon, and his portraits wear the ram's horn. In this he had only imitated the Pharaohs of the nineteenth dynasty. Amen is only mentioned by the Hebrew prophets in speaking of Diospolis as the city of No or No Amon.

AMMON, CHRISTOPH FRIEDRICH VON, a distinguished theological writer and preacher, was born at Baireuth in January 1766, studied at Erlangen, held various professorships in the philosophical and theological faculties of Erlangen and Göttingen, succeeded Rheinhard in 1813 as court preacher and counsellor at Dresden, retired from these offices in 1849, and died May 21, 1850.

AMMONIA (NH³), sometimes called the *Volatile alkali*, or *Alkaline air*, was known to the alchemists in aqueous solution. Priestley first separated it in the gaseous state in 1774. Scheele in 1777 discovered that it contained nitrogen, and its true composition was ascertained by Berthollet about 1785. Ammonia occurs in the atmosphere as carbonate and nitrate, in sea-water, and in many mineral springs. Its aqueous solution is used in medicine internally as a stimulant, and externally as vesicant; it is much used in the arts and sciences, and is of special value in photographic operations.

AMMONIAC, SAL (NH₄Cl), the earliest known salt of ammonia, now named *chloride of ammonium*, formerly much used in dyeing and metallurgic operations.

The name *Hammoniæcus sal* occurs in Pliny, who relates that it was applied to a kind of fossil salt found below the sand, in a district of Cyrenaica. It was similar in appearance to the *alumen scissile*, and had a disagreeable taste, but was useful in medicine. The

general opinion is, that the *sal-ammoniac* of the ancients was the same as that of the moderns; but the imperfect description of Pliny is far from being sufficient to decide the point.

Some derive the name *sal-ammoniac* from Jupiter Ammon, near whose temple it is alleged to have been found; others from a district of Cyrenaica called Ammonia. Pliny's derivation is from the sand in which it occurred.

It is of especial value in medicine in chronic bronchitis, or in any affection of the system in which it is desirable to increase the bronchial secretion. A cough sirup of ammonium chloride, $\frac{1}{2}$ oz. in 6 oz. of sirup licorice, with 2 drachms fluid extract *cannabis indica*, is an excellent remedy for bronchial coughs and "common colds."

Egypt is the country where *sal-ammoniac* was first manufactured, and from which Europe for many years was supplied with it. This commerce was first carried on by the Venetians, and afterwards by the Dutch. Nothing was known about the method employed by the Egyptians till the year 1719.

The first attempt to manufacture *sal-ammoniac* in Europe was made about the beginning of the 18th century, by Mr. Godwin, a chemist of London, who appears to have used the mother ley of common salt and putrid urine as ingredients.

Chloride of ammonia is now manufactured in large quantities from the crude carbonate of ammonia obtained in gas-works, or from the destructive distillation of animal matter.

Sal-ammoniac occurs usually in the form of a hard, white cake, opaque, or slightly translucent. Its taste is cooling, saline, and rather disagreeable.

AMMONIACUM, or AMMONIAC, a gum-resinous exudation from the stem of a perennial herb (*Dorema ammoniacum*) belonging to the natural order Umbelliferae. The plant grows to the height of 8 or 9 feet, and its whole stem is pervaded with a milky juice, which oozes out of an incision being made at any part. This juice quickly hardens into round tears, forming the "tear ammoniacum" of commerce. It may be used as a substitute for assafoetida, although containing a much smaller proportion of volatile oil, its effect is less powerful. Internally it is used in conjunction with squills in bronchial affections; and in asthma and chronic colds it is found useful. It is, however, more used externally in the form of plasters, as a discutient or resolvent application in indolent tumors, affections of the joints, &c.

AMMONITES, a genus of fossil shells, nearly allied to the recent genus *Nautilus*, being, like it, chambered and spiral. The ammonites proper are Mesozoic forms and are characteristic of the Jurassic and Cretaceous systems. Many hundred species are known. They differ greatly in size, some being very minute, and others as large as cart-wheels. The study of Ammonites has attracted many scientific students.

AMMONITES, called also very frequently *the children of Ammon*, a people allied by descent to the Israelites, and living in their vicinity, sprung from Lot, Abraham's nephew, by the younger of his daughters, as the immediately adjoining people, the Moabites.

AMMONIUS, surnamed HERMLÆ, or the son of Hermias, studied at Alexandria, along with his brother Heliodorus, under the neo-Platonist Proclus during the latter part of the 5th century A.D. He was afterwards the head of a school for philosophy; and among his scholars were Asclepias, John Philoponus, Damascius, and Simplicius. Although a neo-Platonist, Ammonius appears to have devoted most of his attention to the works of Aristotle. Commentaries on some of these are all that remains of his reputedly numerous writ-

ings. Of the commentaries we have—1. One on the *Isagoge* of Porphyry, published at Venice, 1500, fol.; 2. One on the *Categories*, Venice, 1503, fol., the authenticity of which is doubted by Brandis; 3. One on the *De Interpretatione*, Venice, 1503, fol.

AMMONIUS, surnamed SACCAS, or "The Sack Carrier," from the fact of his having been obliged in the early part of his life to gain his livelihood by acting as a porter in the market, lived at Alexandria during the 2d century, A.D., and died there 241 A.D. Ammonius, after long study and meditation, opened a school for philosophy in Alexandria. Among his pupils were Herennius, the two Origens, Longinus, and, most distinguished of all, Plotinus, who in his search for true wisdom found himself irresistibly attracted by Ammonius, remained his close companion for eleven years, and in all his later philosophy professed to be the mere exponent of his great master. Ammonius himself designedly wrote nothing, and the doctrines taught in his school were, at least during his life, kept secret, after the fashion of the old Pythagorean society. He undoubtedly originated the neo-Platonic movement, but it cannot be determined to what extent that philosophy, as known to us through Plotinus and Proclus, represents his ideas.

AMMUNITION in its general sense comprises not only the powder and projectiles employed in guns of all classes, but also all stores directly connected with artillery fire, such as friction-tubes, fuses, percussion-caps, and rockets.

Gunpowder, as manufactured in England, consists of 75 parts of saltpetre, 15 parts of charcoal and 10 parts of sulphur, reduced to a fine powder and mechanically mixed together, pressed into a cake, and granulated to a size varying according to the purpose which it is designed to fulfil. In cannon, a large grain is necessary for regular and thorough burning, a fine powder choking up the interstices, and so preventing the flame from finding its way through the entire charge. On the other hand, a large grain is blown out of a small piece before it is burnt to the centre. For the very heavy guns recently introduced into the military service powder formed into "pellets" or "pebbles" has been adopted, by which the pressure of the gas is kept up till the shell leaves the muzzle, without being at any instant excessive and likely to injure the gun. Modified forms of powder and gun cotton have been employed experimentally as the charges of guns.

For heavy guns or cannon the charge is carefully weighed and made up in a serge cartridge sewn with worsted, which entirely consumes in firing—any residue left ignited in the bore being liable to cause explosion when the cartridge of the succeeding round is rammed down on it, and so to blow off the arms of the gunner using the sponge stave. The shell or other projectile employed is forced home on the cartridge in muzzle-loading guns. In breech-loaders the shell is introduced first, and pressed into the shot chamber, beyond which it can only pass by the "lands" of the rifling cutting into the lead coat, which is effected by the explosion of the charge. The cartridge is pressed forward against the base of the projectile.

Rifled guns—that is, guns constructed to impart rotation to the projectiles they discharge—have superseded smooth-bored cannon in the armaments of all civilised nations; elongated projectiles, which are impeded by the resistance of the air much less than spherical ones, being in all cases employed. The following kinds of projectiles are fired from rifled cannon in the American service: Common shell, Shrapnel shell, Palliser shell and shot, and case-shot. Light balls, carcasses, and spherical shells are discharged from smooth-

bored mortars. The two last mentioned, as well as spherical Shrapnel, round shot, grape, and case, are fired from smooth-bored guns.

Common shell for rifled guns are simply hollow elongated projectiles filled with powder, which is fired by the action of a fuse, and bursts the shell with great violence, acting in walls or earth into which it has penetrated like a small mine, the largest shells, which are twelve inches in diameter, containing nearly 37 lb. of powder. Gun cotton, nitroglycerine, and other substances, have been tried for bursting purposes, but it has been found very difficult to prevent premature explosion from the sudden shock of discharge of the gun.

Shrapnel shell are hollow projectiles containing bullets and a very small bursting charge. The shell follows the usual course of flight up to within about 100 yards of the object, when the time fuse, if properly set, fires the bursting charge, and opens the shell by splitting it along certain grooves forming lines of least resistance. The bullets and fragments then continue their course in the form of a shower of missiles.

The *Armstrong segment shell* fulfils the same general purpose,—that is to say, it is designed to sweep down bodies of troops, but it opens rather more suddenly, segments of iron taking the place of lead and antimony bullets.

Palliser shell and shot are projectiles made with specially hard and rigid heads, with the object of piercing the sides of armor-clad vessels.

Dynamite must be placed in the list of the various kinds of ammunition. Lieut. Zalinsky, U. S. A., has succeeded in so perfecting his pneumatic gun that several new vessels of the United States navy are armed with this formidable weapon. This gun throws a hollow shell filled with dynamite, the projectile force used being compressed air. The gun is built at a fixed angle with the keel of the vessel, and aim is secured by maneuvering the ship. The charge of dynamite used (500 pounds) is sufficient to destroy the heaviest war vessel if it falls within a considerable distance, thus rendering accuracy of aim of no great moment, and making it almost impossible to fail to injure an opponent.

Time fuses are those which open a shell at any given time, whether in the air or during penetration. A *percussion fuse* is one that acts on impact graze.

Rockets are projectiles containing composition which, as it burns, generates sufficient gas to drive forward the rocket by an action like that of the recoil of a gun.

AMNESTY, an act of grace by which the supreme power in a state restores those who may have been guilty of any offense against it to the position of innocent persons. It includes more than pardon, inasmuch as it obliterates all legal remembrance of the offense. It is chiefly exercised toward associations of political criminals, and is sometimes granted absolutely, though more frequently there are certain specific exceptions.

AMNION, the foetal membrane which immediately invests the embryo in mammals, reptiles, and birds. As gestation proceeds, the outer portion of this membrane secretes from its inner surface a fluid which distends the inner portion, or amnion proper, and within which the fetus floats suspended by its umbilical cord. The fluid preserves the fetus from injury and pressure, and permits the free movements of its limbs. When gestation is completed and labor begins, the amniotic fluid is the chief mechanical agent in dilating the *os uteri*, and the rupture of the amnion, known as the "breaking of the water," is one of the evidences of approaching delivery.

AMOL, or AMUL, a town of Persia, in the province of Mazanderan, about twelve miles above the mouth of the Heraz. Population in 1889, about 50,000.

AMONTONS, GUILLAUME, celebrated French ex-

perimental philosopher, was the son of an advocate who had left his native province of Normandy and established himself at Paris, where the subject of this notice was born on the 31st August 1663. One of the first objects which engaged his attention was the discovery of the perpetual motion,—an attempt which, though necessarily unsuccessful, was productive of greater advantage to him than it has usually been to those who have pursued that vain chimera. Amontons devoted himself particularly to the improvement of instruments employed in physical experiments, a subject which requires the finest applications of mechanical principles, and which till that time had not met with a due share of attention. In 1687, before he had attained his 24th year, he presented to the Academy of Science an hygrometer of his own invention, which was received with approbation by that learned body. In 1695 he published the only work which he has given to the world. It was dedicated to the Academy, and entitled *Remarques et Expériences Physiques sur la Construction d'un Nouvel Clepsydre, sur les Baromètres, les Thermomètres et les Hygromètres*. In 1689 Amontons was admitted into the Academy of Sciences, the Memoirs of which he enriched with many important contributions. By his countrymen he is generally regarded as the inventor of the telegraph; and he had the honor of exhibiting the methods by which he proposed to accomplish the object in view before some members of the royal family. Amontons died in 1705, aged 42.

AMoor, AMOUR, or AMUR, a large and important river of eastern Asia, formed by the confluence of the Argun and the Shilka, at a place called Ust Strelkoi. Both these rivers come from the south-west. The Amoor proper flows at first in a south-easterly direction for about 800 miles, it then turns to the north-east, and after a total course of over 1600 miles discharges itself into the Sea of Okhotsk, opposite to the island of Saghalien. Its principal tributaries from the south are the Songari, which the Chinese consider to be the true head river of the Amoor, and the Ussuri; from the north it receives the Zeya, the Bureia, the Gyrin, and the Omogun. The climate of the valley of the Amoor varies very much in different parts: in the upper portion of its course there are long and cold winters and short summers; as the river descends into more southern latitudes the rigor of the climate relaxes, and the heat becomes almost tropical; the vegetation is rich and luxuriant, and large forests of oaks, limes, and elms replace barren larches and firs; while on the lower Amoor the cold again to a certain extent prevails, and at the mouth the river is ice-bound for more than half the year, a circumstance which greatly impairs its otherwise admirable facilities for navigation.

AMORITES, a powerful people, widely spread through the Promised Land before the settlement of the Israelites, belonging to the Canaanitic stock, according to Gen. x. 16, though some think they belong rather to the pre-Canaanitic inhabitants of the Jordan basin. In all probability there were incorporated among them the remnants of the older tribe of the Rephaim. See CANAANITES.

AMORPHISM, a term used in chemistry and mineralogy to denote the absence of regular structure in a body.

AMOS (not the same as Amoz, the father of Isaiah) was an inhabitant of the district of Tekoa, a fortified town among the hills of the south of Judah, where a breed of stunted sheep and goats, prized, however, for their wool and hair, found a scanty pasture.

The date of the first public appearance of Amos cannot be ascertained. He flourished in the greatest age of Hebrew prophecy. He seems to have been

younger than Joel, to whose prophecy he makes several references, and more or less senior to Hosea and Isaiah. This view is fully borne out by the gradual emergence of the Assyrians on the prophetic horizon. Altogether absent from Joel's prophecy, they are but vaguely alluded to in Amos, and first mentioned by name in Hosea and Isaiah.

The simplicity of his style is that of the highest art. He delights in abrupt short clauses, but they are linked together by the closest parallelism. And the supposed rusticity of his dialect is deduced from the spelling of only five words, analogies to which may be traced in the great poem of Job. All that we can admit as probable is, that the native force and talent for observation displayed by this prophet were derived from his early converse with nature on the wild hills of Judah. His imagery, in fact, from its freshness and appropriateness almost reminds us of Dante, and entitles him to as high a place in the history of literature as in that of theistic religion.

AMOY, a city and seaport in the province of Fo-kien, China, situated on the slope of a hill, on the south coast of a small and barren island of the same name. Amoy was captured by the British in 1841, after a determined resistance, and is one of the five ports that were opened to British commerce by the treaty of 1842; it is now open to the ships of all nations. The population of Amoy is estimated at 95,600; that of the island at 400,000.

AMPERE, ANDRÉ-MARIE, the founder of the science of electro-dynamics, was born at Lyons in January 1775. He took a passionate delight in the pursuit of knowledge from his very infancy, and is reported to have worked out lengthy arithmetical sums by means of pebbles and biscuit-crumbs before he knew the figures. His father began to teach him Latin, but left this off on discovering the boy's greater inclination and aptitude for mathematical studies. The young Ampère, however, soon resumed his Latin lessons, to enable him to master the works of Euler and Bernouilli. In later life he was accustomed to say that he knew as much about mathematics when he was eighteen as ever he knew; but his reading embraced nearly the whole round of knowledge,—history, travels, poetry, philosophy, and the natural sciences. At this age he had read the whole of the *Encyclopédie*, and with such interest and attention that he could repeat passages from it fifty years after. When Lyons was taken by the army of the Convention in 1793, the father of Ampère, who, holding the office of *juge de paix*, had stood out resolutely against the previous revolutionary excesses, was at once thrown into prison, and soon after perished on the scaffold. This event produced such an impression on the susceptible mind of Ampère, that he continued for more than a year in a state little removed from idiocy. But Rousseau's letters on botany falling into his hands, the subject engrossed him, and roused him from his apathy. His passion for knowledge returned. From botany he turned to the study of the classic poets, and to the writing of verses himself. His small treatise, *Considérations sur la Théorie Mathématique du Feu* (Lyons, 1802), in which he successfully solved a problem that had occupied Buffon, Pascal, and others, and demonstrated that the chances of play are decidedly against the habitual gambler, attracted considerable attention. On the 11th of September 1820 he heard of the discovery of Professor Oersted of Copenhagen, that a magnetic needle may be deflected by a voltaic current. On the 18th of the same month he presented a paper to the Academy, containing a far more complete exposition of the phenomenon, which he had in the interval investigated by experiment, and showing that magnetic defects can be

produced, without magnets, by aid of electricity alone. In particular he showed that two wires connecting the opposite poles of a battery attract or repel each other according as the currents pass in the same or in opposite directions. According to the theory of magnetism which Ampère's subsequent investigations led him to adopt, every molecule of magnetic matter is acted on by a closed electric current, and magnetisation takes place in proportion as the direction of these currents approaches parallelism. The whole field thus opened up he explored with characteristic industry and care. He anticipated the invention of the electric telegraph, having suggested in 1821 an apparatus of the kind with a separate wire for each letter. Late in life he prepared a remarkable work on the classification of the sciences, which was published after his death. In addition to this and one or two works of less importance, he wrote a great number of memoirs that appeared in scientific journals. He died at Marseilles in June 1836.

AMPÈRE, JEAN-JACQUES-ANTOINE, the only child of the preceding, was born at Lyons, August 12, 1800. He showed an early preference for literary pursuits, and this was strengthened by his intimate intercourse with the brilliant circle to which his introduction to Madame Récamier's celebrated *réunions* admitted him. He began his literary career as a contributor to the *Globe* and *Revue Française*, which Guizot conducted in opposition to the government of Charles X. After spending some time in travel, he commenced a course of lectures at the Athenæum of Marseilles in 1830, the first of which, *De l'Histoire de la Poésie*, he published. The revolution of July led to his return to Paris, where he lectured at the Sorbonne, till, in 1833, he succeeded Andrieux as professor of the history of French literature in the college of France. His lectures here, which were greatly admired, form the basis of several works, particularly of his *Histoire littéraire de la France avant le 12^{me} Siècle*. Ampère was a constant contributor to various periodical publications. He wrote for the *Revue des Deux Mondes* sprightly accounts of his long journeys in Egypt and North America, as well as in various parts of Europe, which were afterward collected under the title, *Littérature et Voyages* (2 vols., 1834). His principal work is the *Histoire Romaine à Rome* (4 vols., 1856-64), a series of papers, reprinted in part from the *Revue des Deux Mondes*, showing shrewd sense and great and varied learning, particularly on archaeological questions, and written in an attractive though often discursive style. He died March 27, 1864.

AMPHIARAUS, in Greek legend a son of Oicles and Hypermnestra, descended on the paternal side from the kingly seer Melampus, and, like his ancestor, endowed with the prophetic gift; but at the same time known for his valor in the great enterprises of his time — the expedition of the Argonauts and the hunt of the Calydonian boar. The expedition, however, on which the chief events of his life hinge is that of the Seven against Thebes, into which he was unwillingly driven by the treachery of his wife, a sister of Adrastus, who then ruled in Sicyon, and by whom the enterprise was planned to restore Polynices to the throne of Thebes. As prince of Argos, Amphiarus was in a position to assist greatly; but when called upon by Adrastus to take a part, he declined, on the ground that the cause was unholy, and would end fatally. His marriage with Eriphyle, however, had not only been meant to heal previous quarrels between him and Adrastus, but was to be a bond of peace for the future in this way, that she should always arbitrate between them. To secure her favor now, Polynices gave her the fatal necklace which Cadmus had once given to Harmonia, and, though warned of the consequences, Eriphyle accepted it and

decided against her husband. Knowing that he would never return, Amphiarus enjoined his son Alcmaeon, then a boy, to avenge his death upon his mother; and to his children generally he gave wise counsel. As he stepped into his chariot to depart he turned with a look of anger towards his wife, a scene which was represented on the chest of Cypselus. The assault of Thebes was disastrous to the Seven; and Amphiarus, pursued by Periclymenus, would have fallen by his spear had not Jupiter, at a critical moment, struck the earth with a thunderbolt, and caused it to open and swallow him with his horses, Thoas and Dias, his chariot, and his charioteer, Baton.

AMPHIBIA. Linnæus originally employed this term to denote a class of the Animal Kingdom comprising crocodiles, lizards and salamanders, snakes and *Cecilia*, tortoises and turtles, and frogs; to which, in the later editions of the *Systema Naturæ*, he added some groups of fishes. In the *Tableau Élémentaire*, published in 1795, Cuvier adopts Linnæus's term in its earlier sense, but uses the French word "Reptiles," already brought into use by Brisson, as the equivalent of *Amphibia*. In addition, Cuvier accepts the Linnæan subdivisions of *Amphibia-Reptilia* for the tortoises, lizards (including crocodiles), salamanders, and frogs; and *Amphibia-Serpentes* for the snakes, apodal lizards, and *Cacilia*.

In 1799 Brongniart pointed out the wide differences which separate the frogs and salamanders (which he terms *Batrachia*) from the other reptiles; and in 1804, Latreille, rightly estimating the value of these differences, though he was not an original worker in the field of vertebrate zoology, proposed to separate Brongniart's *Batrachia* from the class of *Reptilia* proper, as a group of equal value, for which he retained the Linnæan name of *Amphibia*.

Cuvier went no further than Brongniart, and, in the *Règne Animal*, he dropped the term *Amphibia*, and substituted *Reptilia* for it. Meckel, on the other hand, while equally accepting Brongniart's classification, retained the term *Amphibia* in its earlier Linnæan sense; and his example has been generally followed by German writers; as, for instance, by Stannius, in that remarkable monument of accurate and extensive research, the *Handbuch der Zoologie* (Zweite Auflage, 1856).

In 1816, De Blainville, adopting Latreille's view, divided the Linnæan *Amphibia* into *Squamifères* and *Nudipeltifères*, or *Amphibiens*; though he offered an alternative arrangement, in which the class *Reptiles* is preserved and divided into two sub-classes, the *Ornithoides* and the *Ichthyoides*. The latter are Brongniart's *Batrachia*, plus the *Cacilia*, whose true affinities had, in the meanwhile, been shown by Duméril; and, in this arrangement, the name *Amphibiens* is restricted to *Proteus* and *Siren*.

Merrem's *Pholidota* and *Batrachia* (1820), Leuckart's *Monopnoa* and *Dipnoa* (1821), Müller's *Squamata* and *Nuda* (1832), are merely new names for De Blainville's *Ornithoides* and *Ichthyoides*, though Müller gave far better anatomical characters of the two groups than had previously been put forward. Moreover, following the indications already given, by Von Bär in 1828 Müller calls the attention of naturalists to the important fact, that while all the *Squamata* possess an amnion and an allantois, these structures are absent in the embryos of all the *Nuda*. Müller makes an appeal for observations on the development of the *Cacilia*, and of those *Amphibia* which retain gills or gill-clefts throughout life, which has unfortunately yielded no fruits from that time to this.

In 1825, Latreille published a new classification of the *Vertebrata*, which are primarily divided into *Hæma*

therma, containing the three classes of *Mammifera*, *Monotremata*, and *Aves*: and *Hemacryma*, also containing three classes—*Reptilia*, *Amphibia*, and *Pisces*. This division of the *Vertebrata* into hot and cold blooded is a curiously retrograde step, only intelligible when we reflect that the excellent entomologist had no real comprehension of vertebrate morphology; but he makes some atonement for the blunder by steadily upholding the class distinctness of the *Amphibia*. In this he was followed by Dr. J. E. Gray; but Duméril and Bibron in their great work, and Dr. Günther in his *Catalogue*, in substance, adopt Brongniart's arrangement, the *Batrachia* being simply one of the four orders of the class *Reptilia*. Professor Huxley has adopted Latreille's view of the distinctness of the *Amphibia*, as a class of the *Vertebrata*, co-ordinate with the *Mammalia*, *Aves*, *Reptilia*, and *Pisces*; and the same arrangement is accepted by Gegenbaur and Haeckel. In the Hunterian lectures delivered at the Royal College of Surgeons in 1863, Professor Huxley divided the *Vertebrata* into Mammals, Sauroids, and Ichthyoids, the latter division containing the *Amphibia* and *Pisces*. Subsequently he proposed the names of *Sauropsida* and *Ichthyopsida* for the Sauroids and Ichthyoids respectively. It is proper to mention, finally, that Professor Owen, in his work on *The Anatomy of Vertebrates*, follows Latreille in dividing the *Vertebrata* into *Hematotherma* and *Hematoerya*, and adopts Leuckart's term of *Dipnoa* for the *Amphibia*.

The *Amphibia* are distinguished from the *Sauropsida* and *Mammalia* by very important and sharply-defined characters. The visceral arches of the embryo develop gills, which temporarily, or permanently, perform the respiratory function. There is no trace of an amnion, and it is still a question whether the urinary bladder, which all *Amphibia* possess, answers to the allantois of the higher *Vertebrata* or not. At any rate, it plays no part in the respiration of the embryo, nor is it an organ by which nutriment is obtained from the parent. There are two occipital condyles, and the basi-occipital region of the skull is either very incompletely, or not at all, ossified. There is no basi-sphenoidal ossification. When young, the *Amphibia* are provided with, at fewest, three, and usually four, cartilaginous, or more or less ossified, branchial arches. From *Pisces*, on the other hand, they are distinguishable only by the characters of their locomotive apparatus. When they possess median fins and limbs, these never present fin-rays; and the limbs exhibit, in full development, the type of structure which obtains among the *Sauropsida* and *Mammalia*, and differ very widely from the fins of any fish at present known. This difference obtains even among the long extinct *Amphibia* of the Carboniferous epoch. In other respects, the lower *Amphibia* approach the *Chimæra*, the *Ganoidei*, and the *Dipnoi* very closely; while, in their development, they present curious approximations to the *Marsipobranchii*.

With respect to the primary subdivisions, or orders, of the class *Amphibia*, no one can doubt the propriety of the separation of the recent forms into what may be broadly termed Newts (*Urodela*); Frogs and Toads (*Anura*); and *Cæcilia* (*Peromela*) effected by Duméril; while all that is known of the organisation of the extinct *Amphibia* of the newer Palæozoic, and older Mesozoic, formations tends to show that they form a fourth natural assemblage of equal value to each of the others.

The names of *Urodela* and *Anura*, given to the first two of these divisions, are undoubtedly open to criticism; but if well-understood terms, which have acquired a definite scientific connotation, are to be changed whenever advancing knowledge renders them etymologically inappropriate, the nomenclature of taxonomy

will before long become hopelessly burdened; and, to set a good example, the names of *Urodela*, *Anura*, *Peromela*, and *Labyrinthodonta* are adopted here for the four orders of the *Amphibia*, even although it be true that the *Labyrinthodonta* do not all possess the dental structure on which the name was founded; though there is reason to believe that some Labyrinthodonts were devoid of limbs, or peromelous; that the *Anura* are not more tail-less than are the *Peromela*; and that the tails of the *Urodela* are not more conspicuous than were those of the Labyrinthodonts.

The *URODELA* are *Amphibia* with elongated bodies and relatively short limbs, devoid of scales or pectoral plates, with numerous præ-caudal vertebrae, and with amphicœlous, or opisthocœlous, vertebral centra. The hyoidean arch remains connected with the suspensorium throughout life, and its cornua are large in proportion to its body. The mandible is dentigerous. There are one or two pairs of limbs, the pectoral arch and limbs being always present. The manus never possesses more than four digits. The bones of the antebrachium and of the crus remain distinct, and the tarsus is not elongated. So far as the spermatozoa are known, they are elongated filaments with a vibratile fringe. The larva develops external gills only; and, except *Siren*, none are known to possess, at any time, a horny masticatory apparatus.

The *ANURA* have relatively short and broad bodies, and both pairs of limbs are constantly present, the hinder being the longer and stronger. There are no scales, nor pectoral plates, but ossification sometimes occurs in the dorsal integument. The vertebrae vary in character, but are usually proœlous. The præ-sacral vertebrae never exceed nine in number, and the caudal portion of the vertebral column is represented by a peculiar styliform coccyx. The hyoidean arch detaches itself from the suspensorium, and almost always becomes connected with the pro-otic region of the skull. The cornua are usually slender, as compared with the broad body of the hyoid. The mandible is almost always devoid of teeth. The bones of the antebrachium and of the crus early ankylose, and the astragalus and calcaneum are much elongated. The manus has a rudimentary fifth digit. Except in *Bombinator*, the spermatozoa have flagelliform appendages, like those of ordinary *Vertebrata*. The larvæ develop first external, and afterwards internal, gills, and, so far as is known at present, are provided with deciduous horny masticatory plates. The gill apertures are closed by the growing over them of an opercular membrane.

The *PEROMELA* have snake-like bodies, totally devoid of limbs and limb arches. In most, the integument is provided with transverse rows of imbedded cycloid scales, but there are no pectoral plates. The vertebrae of the trunk are very numerous, and are amphicœlous; those of the caudal region are very few, and are free. The hyoidean arch is attached neither to the suspensorium, nor to the skull; its cornua are very slender, and no distinct body is developed; it is followed by several slender, hoop-like branchial arches. The mandible is dentigerous. Nothing is known of the early stages of development; but Müller discovered branchial clefts, with rudimentary branchial filaments, in young *Cæcilia*.

The *LABYRINTHODONTA* for the most part resembled the *Urodela* in the proportions of the tail and limbs to the body, but some (as *Ophiderpeton*) were serpentine, and apparently apodal; no raniform Labyrinthodonts have yet been discovered. The vertebrae are amphicœlous. The mandible is dentigerous. The bones of the antebrachium and crus remain distinct, and the tarsus is not elongated. The manus and pes appear to have been pentadactyle. Three sculptured pectoral plates and a

peculiar dermal armor of small scales, confined to the ventral face of the body, are present in many genera. Nothing is known of the early stages of development, but the young *Archegosauria* appear to have possessed ossified branchial arches.

AMPHICTYONY, in *Greek Antiquity*, was an association of several tribes for the purpose of protecting some temple common to them all, and for maintaining worship within it. The members were called "the dwellers around." Out of the name the Athenians, according to their habit, easily discovered the founder of the Delphic Amphictyony, with which they were connected; and hence in later times, by an inverse process, the name was derived from Amphictyon, one of the fabulous kings of Attica.

Similar religious confederations existed in Greece at a very early period, and there is reason to believe that at their stated assemblies they discussed questions of international law and matters affecting their political union as well as religious subjects. Gradually, however, the political influence of the Amphictyonies died away. As states of great power stood on an equality with insignificant tribes in the number of votes, they naturally prevented the settlement of important political matters in such an assembly. Accordingly, during the flourishing period of Greek history the Amphictyonies almost disappear. They are not mentioned in Thucydides and Xenophon. But they appear again in vigor in the time of Philip, and become engines by which political parties, under pretence of religious zeal for the interests of the gods, wreak their vengeance on their rivals and antagonists.

This is especially true of the Amphictyony of Delphi, the most important of all these associations. Though we know better about this confederation than about any other, yet many particulars are hidden in obscurity, and considerable doubts gather around others of which we know something. The Amphictyony existed in very early times, and Æschines states that it arose when the temple at Delphi was first built. It is more likely, however, that it was originally connected with Thermopylæ and the temple of Demeter Amphictyonis which was there. The Amphictyony consisted of a union of twelve tribes, each of which had a right to two votes. These tribes were for the most part Thessalian or bordering on Thessaly; and it is probable that the others, as the Dorians and Ionians, gained admission in consequence of colonies that came to them from Thessaly.

There are nine lists of the tribes that constituted the Delphic Amphictyony in the classical writers and in inscriptions. Of these only one is complete, and the rest differ from each other in some particulars. The one that is completed was found on a Delphic stone containing a decree of the Amphictyonic council in regard to money due to the Delphic treasury. On this stone are given the votes of each tribe, and the final decision of the council in harmony with the majority of votes for one of the opinions held. The list is as follows: — The Delphians, two votes; Thessalians, two votes; Phocians, two votes; Dorians from Metaopolis, one vote; the Dorians from Peloponnesus, one vote; the Athenians, one vote; the Eubœans, one vote; the Bœotians, two votes; the Achæan Phthiots, two votes; the Malians, one vote; the Eteans, one vote; the Dolophians, one vote; the Perrhæbians, one vote; the Magnetes, two votes; the Ænians, two votes; the Locri Hypocnemidii, one vote; the Locri Hesperii, one vote. The exact date of the decree recorded on the Delphic stone is matter of dispute, but the most probable conjecture places it about the year 130 B. C. It is generally believed that no change took place in the tribes forming

the league till the time of the second sacred war, 345 B. C. Of these tribes, Æschines gives us a list, with the omission of one. They are the Thessalians, Bœotians, Dorians, Ionians, Perrhæbians, Magnetes, Locri, Eteans, Phthiots, Malians, Phocians; and there can be little doubt that it is the Dolophians who have been by some mistake omitted. The confusions in some of the other lists have arisen probably from the ignorance of transcribers, who did not know that the Ænians and Eteans lived close to each other, and were often comprehended under the same name, and who made two tribes of the Achæan Phthiots, Achæans and Phthiots. Æschines says that all these tribes had equal right of voting; but the inscription on the Delphic stone shows that the two votes of one tribe might be divided among two different portions of it. At the conclusion of the Phocian war the Phocians were excluded, and the Macedonians received their votes; and the vote of the Lacedæmonians was given to the other Doric tribes of Peloponnesus. The Delphians also obtained votes, either at this time or after the third sacred war, 338 B. C., by some of the smaller tribes that had two votes being restricted to one. In the same way, and also by the exclusion of the Locri Ozolæ, the Ætolians secured a place in the council in 338 B. C., and gradually took possession of a great number of votes. The Phocians were restored to their place in 279 B. C., on account of their gallant resistance to the Gauls. Finally, the Ætolians and Macedonians were excluded from the council, and the constitution of the council as given in the Delphic stone was formed. The last change mentioned in classical writers is detailed by Pausanias, but the passage is evidently corrupt. Augustus wished to give votes to Nicopolis, and for this purpose so altered the constitution of the council as to make the votes thirty in number.

The objects of the league are distinctly expressed in the oath which the Amphictyons had to take, and which is preserved in Æschines's oration "De Falso Legatione." This oath bound the Amphictyons not to destroy any of the Amphictyonic towns, not to turn away its running waters either in time of war or in time of peace; and if any one should attempt to rob the temple of Delphi (the common centre of the confederacy), to employ their hands, feet, tongue; and their whole power to bring him to punishment. The humanising influence which this and other enactments of the confederacy were intended to exercise, is perceptible in the part relating to war. The framer of the law evidently regarded war only as an unavoidable means of settling disputes between two states; but it was to be carried on only for the purpose of bringing the dispute to a decision, and not for destruction and devastation.

There is difficulty in determining how often the Amphictyons met. But the most likely inference from the somewhat indefinite statements of ancient writers is, that they went twice every year both to Delphi and Thermopylæ, in spring and autumn. There is also some difficulty in determining the relative positions of the two sets of officials named in connection with the Amphictyony, the Hieromnemones and the Pylagoroi or Pylagorai. But there can scarcely be a doubt that the Hieromnemon was the principal official. There were as many Hieromnemones as there were votes; and the Hieromnemones were alone entitled to vote. The assembly proper consisted therefore only of the Hieromnemones. It is most likely that the Hieromnemones were elected annually by lot. In the case of the smaller states it is probable that the right to elect went round by turns, while the more important states sent their representatives every year. There might be several Pylagoroi from each state. Æschines mentions that there were on one occasion three from

Athens. They were elected by vote. Their function seems to have been to advise with the Hieromnemon, to address the assembly when anything relating to their own state was discussed, and to bring all their influence to bear on the assembly on behalf of their own state. The office of Hieromnemon remained in high honor till a late period. When the Dionysiac theatre in Athens was excavated in 1862, a chair of honor was found, and as it is certain that dramatic exhibitions took place in this theatre in the time of the Antonines, the office of Hieromnemon must have existed at that period.

The meetings, however, were attended not only by the deputies, but by thousands of others who flocked to Delphi or Thermopylae for religious and mercantile purposes, or only for the sake of amusement. This occasioned popular meetings distinct from those of the regular deputies. But we cannot suppose that all the Greeks indiscriminately were allowed to take part in those popular assemblies, which must have consisted of visitors from the states which were members of the Amphictyony.

Wise and humane as were the objects of the Amphictyons, yet wherever they actively interfered in the affairs of Greece during the historical period, we find that they were more powerful for evil than for good; and the holy wars which were carried on by them in the defence of the Delphic temple and the honor of its god, contributed not a little to the demoralization of the Greeks.

The very first time that the Amphictyons interfered in the affairs of Greece we find them acting in direct opposition to the spirit of their institution. We allude to the Crissæan or first sacred war, which broke out in 594, and lasted till 585 B.C. The inhabitants of Crissa (or Cirrha), on the Corinthian Gulf, were charged with extortion and violence towards the strangers who landed at their port, or passed through their territory on their way to Delphi. The second sacred war, which likewise lasted for ten years, from 355 to 346 B.C., was carried on with unparalleled exasperation for all that period, and nearly all the Greeks took part in it. The Thebans had set their hearts upon conquering Phocis, but screened their designs behind a charge preferred against the Locrians, alleging that they had robbed the temple of Delphi, because they had taken into cultivation a tract of land belonging to the Delphic temple. The war was carried on with unexampled cruelty, for even the surrender of the dead for burial was refused, and all Phocian captives were put to death. This war also afforded Philip of Macedonia an opportunity to interfere in the affairs of Greece. Being invited by the Thessalians to co-operate with them against the Phocians, Philip and his Macedonians acted as the champions of the god, and defeated the Phocians in a bloody battle near Magnesia. Three thousand captive Phocians were put to death.

There were many other confederations of a similar kind, some of which, however, do not bear the name of Amphictyonies in the authorities from which we derive our information regarding them. The following were among the most noted:—

1. The *Amphictyony of Calauria*, an island near Trezen, consisted of the seven states of Hermione, Epidaurus, Ægina, Athens, Prasieæ, Nauplia, and the Minyan Orchomenos.

2. *Amphictyony of Onehetos*, in the territory of Haliartus in Boeotia, was likewise connected with the temple of Poseidon.

3. *Amphictyony of Amarynthos*, in Eubœa, connected with the temple of Artemis.

4. *Amphictyony of Delos*, connected with the temple of Apollo, was a league formed among the inhabitants

of the Cyclades and the Ionians in the neighborhood. Its institution was ascribed to Theseus.

AMPHION, in *Greek Mythology*, the son of Zeus by Antiope, and the husband of Niobe, was a musician of such wonderful power, that at the sounds of his lyre the stones began to move, and formed themselves into walls around Thebes, after his conquest of that city. He was killed by Apollo for assaulting his temple; or, as some report, he destroyed himself in despair at the slaughter of his children by that god. The famous Farnese bull, discovered in 1546, represents Amphion punishing Dirce for her treatment of his mother. There are four other mythical personages of this name.

AMPHIOXUS, a species of fish, differing widely from all other known animals. See LANCELET.

AMPHIPOLIS, a city of Macedonia, situated on the east bank of the river Strymon, about three miles from the sea. It was originally a Thracian town, and was colonised by the Athenians in 437 B.C., two previous attempts (497 and 465 B.C.) having been unsuccessful. In 424 B.C. it surrendered to the Lacedæmonians without resistance, and the Athenians never afterwards recovered possession of it.

AMPHISBENA, a genus of animals, found only in South America and the West Indies, which, though they have the general appearance of snakes or worms, belong to the order *Lacertilia*, or Lizards.

AMPHITHEATRE denotes a theatre in which the spectators were placed "all round" the stage. Though the word is of Greek formation, the thing itself is distinctively Roman, being designed for those cruel shows of gladiators and wild beasts in which that people took great pleasure, and which in modern times are only represented by the barbarous bull-fights still popular in Spain.

In the present article we do not enter on the consideration of the spectacles themselves, but shall confine ourselves to the buildings, which were devised to allow as large a number of spectators as possible to enjoy the sight of the show. In a dramatic representation it is necessary that the actors should be heard, and also that their faces should be seen, and the audience has therefore to be arranged in a semicircle in front of them; but when men fought with other men or with beasts, they could be seen equally well from all sides.

In Italy, combats of gladiators at first took place in the forums, where temporary wooden scaffoldings were erected for the spectators; and Vitruvius gives this as the reason why in that country the forums were in the shape of a parallelogram instead of being squares as in Greece. Wild beasts were also hunted in the circus. But towards the end of the Roman republic, when the shows increased both in frequency and in costliness as the city grew in power, special buildings began to be provided for them; and when the consolidation of peace under the empire had secured great material prosperity for the provinces, such as they had never enjoyed when separated into small states and often at war with each other, the example of the capital was followed by many other towns in the West; so that nearly a hundred amphitheatres have been identified, either by the existence of their ruins or by being mentioned by old writers. There were even a few in the East, although such cruel games were quite alien to the elegance and refinement of the Hellenic mind.

From their being so admirably adapted for enabling the greatest possible number of people to behold a spectacle, it is natural to suppose that they would be occasionally used for purposes different from those usually intended by them; and accordingly Suetonius relates how Caligula had an impertinent poet burnt alive in the amphitheatre, and how Titus ordered the inform-

ers, after having been whipped in the forum, to be led through the arena, apparently that they might be exposed to the execrations of the people. Criminals were also sometimes exposed in them to be devoured by wild beasts, and many of the Christian martyrs died in this way.

The first amphitheatre was that constructed, 59 B.C., by C. Scribonius Curio. The only author by whom it is described is Pliny, whose account of it rather taxes our credulity. He tells that Scribonius built two wooden theatres, which were placed back to back, and that after the dramatic representations were finished, they were turned round, with all the spectators in them, so as to make one circular theatre, in the centre of which the gladiators fought. And this was repeated more than once. Thirteen years later, Cæsar built (also of wood) the first regular amphitheatre, and exhibited wild beasts in it; and sixteen years after, C. Statilius Tauris built the first one of stone, which was burnt in the great fire of Rome during the reign of Nero. Probably the outside walls only were of stone.

Several others were constructed under the early emperors, but they were entirely superseded and eclipsed by that of Vespasian and Titus, the vast ruins of which strike the traveller with awe. Set on fire by lightning under the emperor Macrinus, it was restored by Alexander Severus, the shows during the interval being held (as of old) in the circus. The latest record of its being used is in the 6th century, when Cassiodorus was present; but Bede in the 8th century speaks of the edifice as still entire. During the Middle Ages many of the stones of this, as of many other ancient buildings, were carried away for building purposes; and among the plunderers we regret to have to reckon the great Michel Angelo, who worked up a large number of its stones into a palace for one of the Roman noble families. As, however, the Colosseum had been the scene of many of the Christian martyrdoms, Benedict XIV., whose name ought never to be mentioned without an expression of admiration and gratitude for his enlightened patronage and antiquities, took advantage of this to consecrate the interior by the erection of crosses and oratories, thereby preserving it from further depredations. Of late years considerable excavations have been made to examine its substructures. Its name is variously written, but on the whole it would seem that the most correct orthography is Colosseum (not Coliseum), and that it is derived from its colossal size, which far surpassed any former edifice of the sort. Many of its minor arrangements are uncertain, but the main features and general plan are sufficiently intelligible.

The external elevation of the Colosseum consisted of four stages, each adorned with engaged columns of the three orders of Greek architecture. The lowest three were arcaded, having each eighty columns and as many arches. Those of the basement story served as entrances; seventy-six being numbered and allotted to the general body of spectators, while four, at the extremities of the axes of the ellipse, were the principal entrances. The higher arcades had a low parapet with (apparently) a statue in each arch, and gave light and air to the passages which surrounded the building. The openings of the arcades above the principal entrances were larger than the rest, and were adorned with figures of chariots. The highest stage was much more solid, being composed of a continuous wall of masonry, only pierced by forty small square windows. The object of this may have been to obtain the necessary solidity and weight for steadying the poles which supported the awning, and must have had to carry a severe inward strain. The alternate arcades were ornamented with metal shields. There were also a

series of brackets to support the poles on which the awning was stretched.

The interior may be naturally divided into the *arena* and the *cavea*, with their respective appendages.

The *arena* was the portion assigned to the combatants, and derived its name from the sand with which it was strewn, to absorb the blood and prevent it from becoming slippery. Some of the emperors showed their prodigality by substituting precious powders, and even gold dust, for sand. The *arena* was generally of the same shape as the amphitheatre itself, and was separated from the spectators by a wall built perfectly smooth, that the wild beasts might not by any possibility climb it. At Rome it was faced inside with polished marble, but at Pompeii it was simply painted. For further security, it was surrounded by a metal railing or network, and the arena was sometimes surrounded also by a ditch (*euripus*), especially on account of the elephants. Connected with the arena were the dens from which the beasts came, and the rooms where the gladiators met before the show began. In spite of the excavations which have been made, it is not very easy to understand how all the effects described by ancient authors were produced; for after the regular shows were over, the arena was sometimes filled with water, and sea-fights were exhibited with ships.

The part assigned to the spectators was called *cavea*. In the different amphitheatres whose ruins have been examined, there are some differences in the arrangements, but the general features are nearly the same in all. The *cavea* was divided into several galleries, concentric with the outer walls, and therefore, like them, of an elliptic form. The place of honor was the lowest of these, nearest to the arena, and called the *podium*. The divisions in it were larger, so as to be able to contain movable seats. At Rome it was here that the emperor sat, his seat bearing the name of *suggestum*, the senators, principal magistrates, vestal virgins, the provider (*editor*) of the show, and other persons of note, occupied the rest of the *podium*.

The height of the Colosseum is given as from 160 to 180 feet. The seats in the interior do not rise higher than the level of the third order of the exterior, that is, about half the entire height of the building; and this apparent excess of height beyond what was made available, has led some to suppose that there were upper seats and galleries, of which no trace now exists. The height, however, appears to have been necessary for the ventilation of the building. When such enormous crowds were packed closely together for several hours at a time on an Italian summer day, with an awning drawn over them, the atmosphere would have become quite pestilential if there had not been a considerable space overhead, and at least one range of open arcades, unnumbered by any galleries to prevent the free circulation of air. Scented liquids were at times squirted over the spectators from concealed tubes; but no aroma would have compensated for the want of air, which the arcade all round the building, above the highest spectators, would supply. There may also have been another series of openings serving the same purpose between the top of the wall and the edge of the awning, which was supported upon poles. It has been calculated that the Colosseum contained 87,000 places, and that besides these, 15,000 more spectators could be admitted. The greatest length is about 612 feet, and the length of the shortest axis of the ellipse about 515 feet. The dimensions of the arena are variously stated by different writers, some making it 247 feet by 150, and others 281 by 176.

AMPHITRITE, in *Greek Mythology*, the supreme goddess of the sea, and as such the wife of Poseidon (Neptune), but, unlike him, so entirely confined in her

authority to the sea and the creatures in it, that not only was her name sometimes used as an equivalent for that element, but she was never associated with her husband either for purposes of worship or in works of art, except when he was to be distinctly regarded as the god who controlled the sea, though generally his functions extended to the whole watery element.

AMPHITRYON, in Greek mythology, a king of Tiryns, son of Alceus, and husband of Alcmena. During his absence his wife was visited by Zeus, disguised as Amphitryon. She became the mother of Hercules by Zeus. Moliere wrote a play, or rather adapted one from Plautus, in which the hero Amphitryon gives a grand dinner, and the name has become synonymous with a host or entertainer.

AMPHORA, a large vessel used by the ancient Greeks and Romans for preserving wine, oil, fruits, etc., and so named from its usually having an ear or handle on each side of the neck.

AMPLITUDE, in Astronomy, is the amount of deviation toward the north or south of a celestial object from the true east at rising, and the true west at setting.

AMPHILL, a small, neatly-built market town in Bedfordshire, England, situated about eight miles south of Bedford. Population in about 2,520.

AMPULLA, a Latin word denoting a small jar or flask for holding liquids. In mediæval church Latin it usually signifies the vessels that contained the consecrated oils, of which the three principal—for the catechumens, for the sick, and for confirmation—were allowed by the bishops on the Thursday before Easter.

AMPUTATION. See **SURGERY**, pages 5627, 5633.

AMRAOTI, a district and city of India, in the commissionership of East Berar, within the Haidarâbâd assigned districts. It is bounded on the north by the Elichpur district; on the east by the Wardhâ river separating it from the central provinces; on the south by the Bâsim and Wum districts; and on the west by Akolâ district. Population in about 600,000.

AMRITSAR, a division, district, and city of British India, under the jurisdiction of the lieutenant-governor of the Panjâb. The Amritsar division comprises the districts of Amritsar, Sialkot, and Gurdâspur.

AMRITSAR DISTRICT is bounded on the northwest by the river Râvi, on the southeast by the river Biâs, on the northeast by the district of Gurdâspur, and on the southwest by the district of Lahore. Amritsar district is a nearly level plain with a very slight slope from east to west. Total population of Amritsar district, 832,750, divided into the following classes:—Hindus, 138,027; Mahometans, 337,135; Sikhs, 223,219; others, 94,369.

AMRITSAR CITY, the divisional headquarters and capital of the district of the same name, lies at an equal distance between the Biâs and Râvi rivers, is about eight miles in circumference, and forms at once the great trading center of the Panjâb, and a celebrated seat of the Sikh region and learning. Pop. (1901), 162,548.

AMRU-BEN-EL-ASS, or **AMER**, one of the most famous of the first race of Saracen leaders, was descended of Aasi, of the tribe of Koreish. In his youth he wrote satirical verses against the person and doctrine of Mahomet. His zeal in opposing the new religion prompted him to undertake an embassy to the king of Ethiopia, in order to stimulate him against the converts whom he had taken under his protection, but he returned a convert to the Mahometan faith, and, along with Khaled, joined the fugitive prophet at Medina. When Abu-Bekr resolved to make a new attack upon Syria, he entrusted Amru with a high command. In this he was so successful that he rose to the elevation of chief in Irak, when Khaled requested the attendance of all the Arabian generals before Damascus. During the

caliphate of Omar he also served in Palestine under Abu-Obeidah, taking the command in the siege of Caesarea, which yielded to him in July 638 A.D. After the death of Obeidah, Amru assumed the chief command in Syria, in which he was confirmed by the caliph, notwithstanding the opposition of Othman. Soon afterwards (639) he led an army of 4000 Arabs into Egypt. To Amru has generally been attributed the burning of the famous Alexandrian library, by command of the caliph Omar. Amru died 663 A.D. In a pathetic oration to his children on his death-bed he bitterly lamented his youthful offence in satirising the prophet, although Mahomet had forgiven him, and had frequently affirmed that "there was no Mussulman more sincere and steadfast in the faith than Amru."

AMRU-EL-KAIS, an Arabian poet, contemporary with Mahomet. He wrote one of the seven *Moallakat* (Suspended), or poems, composed before the promulgation of Mahometanism, which derived their name from the fact that they were suspended in the Kaaba at Mecca. He was hostile to the claims of the prophet, and wrote verses against him.

AMSANCTI (or **AMPSANCTI**) **VALLIS**, a valley with a small sulphureous lake and cavern in the territory of the Hirpini, or Principato Ultra (east of Naples), about four miles from the town of Frigento (Cicero, Pliny), or eight from Gesualdo. The spot can most easily be visited by railway from Ariano, on the Naples and Benevento line.

AMSDORF, NICOLAUS, a Protestant reformer of the 16th century, was born, Dec. 3, 1483, at Gross-Zschopau, near Wurzen, on the Mulde. He was educated at Leipsic, and then at Wittenberg, where he was one of the first who matriculated (1502) in the recently-founded university. He soon obtained various academical honors, and became professor of theology in 1511. He joined Luther at the very beginning of his great struggle (1517); continued all along one of his most admiring and determined supporters; was with him at the Leipsic conference (1519), and the Diet of Worms (1521); and was in the secret of his Wartburg seclusion. He assisted the first efforts of the Reformation at Magdeburg (1524), at Goslar (1531), and at Einbeck (1534); took an active part in the debates at Schmalkald (1537), where he defended the use of the sacrament by the unbelieving; and (1539) spoke out strongly against the bigamy of the Elector of Hesse. He urged the separation of the High Lutheran party from Melancthon (1557), got the Saxon dukes to oppose the Frankfurt Recess (1558), and continued to fight for the purity of Lutheran doctrine. He died at Eisenach, May 14, 1565, and was buried in the high church there, where his effigy shows a well-knit frame and sharp-cut features.

AMSLER, SAMUEL, one of the most distinguished of modern engravers, was born at Schinznach, in the canton of Aargau, in 1791. Amsler's principal engravings are—"The Triumphal March of Alexander the Great," and a full-length "Christ," after the sculptures of Thorwaldsen and Dannecker; the "Burial of Christ," and two "Madonnas," after the pictures of Raphael; and the "Triumph of Religion in the Arts," after Overbeck, his last work, on which he spent six years. He died May 18, 1849.

AMSTERDAM, or **AMSTELDAM**, formerly called *Amstelredam*, capital of the Netherlands, situated in the province of North Holland, is built somewhat in the form of a half-moon, on the Y or Ij, an arm of the Zuyder Zee. The name Amsterdam means "the dam or dyke of the Amstel," from a river so called which passes in a north-easterly direction through the city,—the "dam" referring to the extensive and costly system of embankments, canals, and sluices necessary to secure

this low-lying city against the encroachments of the tide. Towards the land Amsterdam was at one time surrounded by a fosse or canal, and regularly fortified; but its ramparts have been demolished, and the twenty-eight bastions that formed part of the defences are now used as promenades, or covered with buildings. Within the city four canals—the Prinsen Gracht, Keizer's Gracht, Heeren Gracht, and the Singel—extend, in the form of polygonal crescents, nearly parallel to each other and to the former fosse; while numerous smaller canals intersect the city in every direction, dividing it into about 90 islands, with nearly 290 bridges. Some of these are of stone, but the majority are of iron and wood, and constructed so as to allow vessels for inland navigation to pass through. The site of Amsterdam was originally a peat bog, and all its buildings rest upon piles that are driven some 40 or 50 feet through a mass of loose sand and mud until they reach a solid stratum of firm clay. This foundation is perfectly secure as long as the piles remain under water. In 1822, however, an overlaid corn magazine sank into the mud. The piles are liable to the ravages of wood-worms that are supposed to have been brought by vessels from foreign ports. The chief literary institutions of Amsterdam are the Athenæum, the society called "*Felix Meritis*," from the first words of the inscription on their place of meeting; the society "*Natura Artis Magistra*," to whom the zoological gardens belong; the Royal Academy of Fine Arts, and the Seaman's Institute. The galleries of pictures in the city are of great value. The museum in the Trippenhuis contains over 400 works, chiefly of the Flemish and Dutch schools, including the "Night Guard" of Rembrandt, whose statue may be seen on the Kaasplein, opposite the house he occupied, and the "Banquet of the Civic Guard," by Van der Helst; besides nearly 4000 engravings, and a magnificent numismatic collection, considered one of the finest in the world. Among the other collections are those in the Museum Van der Hoop and in the Fodor Museum, that belonging to the "*Arti et Amicitie*" Society, as well as several private galleries.

The population (1901) was estimated at 520,602, of whom about 80,000 are Roman Catholics, and 30,000 Jews, the rest being mostly Protestants of various sects.

The principal imports of Amsterdam are—coffee, amounting in 1888 to 1,147,240 bags and 1,499 casks; tea, in the same year, 79,573 chests; sugar, in the same year, 273,750,000 lb.; tobacco, rice, cotton, indigo, timber, tin, hemp, and grain. The exports comprise cheese, butter, madder, clover, rape, linseed oil, gin, and other products of Holland, besides general goods and manufactures from various European countries. There is also a large export trade in the produce of the East and West Indies. There are two lines of railway, the one connecting Amsterdam with Haarlem, Leyden, and Rotterdam; and the other with Utrecht, Arnheim, and Prussia. Amsterdam has sugar refineries; soap, oil, glass, iron, dye, and chemical works; distilleries, breweries, tanneries; tobacco and snuff factories. The cutting of diamonds has long been extensively practised in the city by the Jews. Although no longer the centre of the banking transactions of the world, Amsterdam is still a place of considerable importance in this respect. The celebrated bank of Amsterdam, founded in 1609, was dissolved in 1796; and the present bank of the Netherlands was established on the model of the Bank of England in 1814.

About the year 1200 Amsterdam was a small fishing village, held in fief by the lords of Amstel, together with the surrounding district, called Amstelland. Towards the close of the 13th century it reverted, in consequence of the complicity of Gysbrecht Van Amstel in the mur-

der of Count Floris V., to the counts of Holland, who gave it a charter and other privileges. It was fortified in 1482, and soon rose to be the most important commercial city of the Netherlands. The early voyages to India, and the union of the seven provinces in 1579, added greatly to the prosperity of Amsterdam—so much so, that it excited the cupidity of the earl of Leicester, who made a futile attempt to surprise it in 1587; and its position was still further improved by the peace of Westphalia in 1648, which closed the navigation of the Scheldt, and consequently ruined the trade of Antwerp. Two years later, the stadtholder William II. intended to surprise it, but the bold attitude of the inhabitants obliged him to give up his project. Amsterdam suffered so severely from the war in the time of Cromwell, that more than 4000 houses stood tenantless; and the French occupation during the First Empire inflicted a more permanent injury upon the city. Since 1813, however, much of its former commercial influence has returned.

AMSTERDAM, a thriving city situated in Montgomery county, N. Y., is situated on the Mohawk river, in Amsterdam township, thirty-three miles from Albany, and sixty-two miles east by south from Utica. It is a leading station on the New York Central and West Shore railroads, a prominent shipping point and manufacturing center. The city contains four banks, three daily and four weekly papers, also one monthly publication, eight churches, a complete and excellent school system, stores, warehouses, public halls, hotels, etc. The manufactures embrace knit goods, shirts, carpets, needles, brushes, boilers, lumber, etc. Pop., 20,929.

AMSTERDAM, an uninhabited and almost inaccessible island in the Indian Ocean, about 60 miles S. of St. Paul's Island, and nearly mid-way between the Cape of Good Hope and Tasmania.

AMULET (in late Latin *amuletum*, probably from the Arabic *hamalet*, a pendant), anything worn as a charm, generally, but not invariably, hung from the neck, to protect the wearer against witchcraft, sickness, accidents, and other evils, or to deliver him from ills under which he labors. Amulets have been of many different kinds, and formed of different substances,—stones, metals, and strips of parchment being the most common, with or without characters or legends engraved or written on them. Gems have often been employed and greatly prized, serving for ornaments as well as for charms. Certain herbs, too, and animal preparations have been used in the same way. In setting them apart to their use as amulets, great precautions have been taken that fitting times be selected, stellar and other magic influences propitious, and everything avoided that might be supposed to destroy or weaken the force of the charm.

AMURATH or MURAD I. was born in 1326 A.D. (726 A.H.), succeeded his father Orkhan as sultan of the Ottoman Turks in 1360, and died in 1389. He is entitled to notice as being the first who led the Turkish arms into Europe, which he quickly overran as far as the Balkan. He lost his life at the close of a great battle at Kossova, which he had successfully fought against Lazarus, despot of Serbia, and was succeeded by his son Bajazet.

AMURATH II., the tenth emperor of the Turks, was born about 1404, and died February 9, 1451. He succeeded Mohammed I. in 1422. At first he had to contend against a pretender, the pseudo-Mustapha, who was supported by the Greek emperor and others; but through the assistance of an astute state prisoner, Mohammed Bey (Michael Ogli), he obtained a bloodless victory over him. He then turned his arms against the Greek emperor himself, but failed in the siege of

Constantinople. Against his younger brother Mustapha he was successful by bribes. In April 1429 he besieged and took Saloniki (*Thessalonica*), which was under Venetian rule, thus opening up the way for the final subjugation of Greece. He continued almost without any reverses of fortune till 1442, when Hunniades defeated his forces in the battle of Vasag, and obliged him to make peace with the Christian princes. The treaty was hardly concluded when his son Ala-Eddin died. In his grief he abdicated in favor of his son Mohammed, a boy of fourteen, while he retired to Magnesia in search of repose. But the Christian princes took advantage of his abdication to renew their attacks, and he was called to oppose them, which he did with terrible success in the battle of Varna, Nov. 10, 1444, when the king of Hungary, Ladislaus, fell. Having saved his country, he again gave up the reins to his son, and returned to Magnesia. But the janissaries revolted, and his presence was demanded. Again on the throne, he invaded Albania and Peloponnesus, but was repulsed by George Castroit or *Scanderbeg*. He retreated, however, only to gain a great victory over his former adversary Hunniades at Cassova (Oct. 17, 1448), the battle lasting three days. He died at Adrianople, Feb. 11, 1451, from a stroke of apoplexy, according to the most probable account.

AMURATH III., sultan of the Turks, born about 1545, succeeded in 1574 his father Selim II. The first words he addressed to his courtiers were—"I am hungry: give me something to eat;" and the evil omen was fulfilled in the famines and disasters that marked his reign. He was fond of dancing and music, and has left a few literary trifles. He died Jan. 16, 1595.

AMURATH IV. was born about 1611, and succeeded his uncle Mustapha in 1623. The chief event of his reign was the recovery in 1638, after thirty days of unremitting assault, of the city of Baghdad which had fallen into the hands of the Persians. He died in 1640, at the early age of twenty-nine.

AMWELL, a village of Hertfordshire, in the parish of Great Amwell, on a hill overlooking the Lea, 3 miles from Hertford and 20 from London.

AMYMONE (Ἀμύμων), in *Greek Legend*, a daughter of Danaüs, by whom, with her sisters, she had been sent to look for water, the district of Argus being then parched through the anger of Neptune. Amymone at the spring is represented on ancient engraved gems.

AMYOT, JACQUES, a famous French writer, was born, of poor parents, at Melun, October 30, 1513; found his way—a pale-faced, bare-footed, ill-clad boy—to the "College de France" in Paris, and there picked up a knowledge of the classical languages, serving some of the richer students as valet and composer of Latin, to enable him to continue his studies. He became M. A. at Paris, and doctor of civil law at Bourges; obtained, through Jacques Colure (or Colin), abbot of St. Ambrose in the latter city, a tutorship in the family of a secretary of state, by the secretary was recommended to the duchess of Berry, only sister of Francis I.; and, through her influence, was made professor of Greek and Latin at Bourges. Here he translated the *Theagenes and Chariclea* of Heliodorus (1547, fol.), for which he was rewarded by Francis I. with the abbey of Bellocane, and thereby enabled to go to Italy to study the Vatican text of Plutarch, on whose *Lives* he had been some time engaged. He died February 6, 1593, bequeathing, it is said, 1200 crowns to the hospital at Orleans for the twelve "deniers" he received there when "poor and naked" on his way to Paris. His fame rests on his vigorous and idiomatic version of Plutarch's *Lives*, which was translated into English by North, and supplied Shakespeare with materials for his Roman plays.

AMYRAUT, MOSES, a pre-eminent French Protestant theologian and metaphysician, was born at Bourgueil, in the valley of Anjou, in 1596. His family was an ancient and illustrious one from Hagenau, Alsace. They migrated to Orleans in the 13th or 14th century. On his way home from the university he passed through Saumur, and having visited Mons. Bouchereau, pastor of the Protestant church there, he introduced him to the renowned lord of Plessis-Mornay, governor of the city. Both were struck with young Amyraut's ability and culture, and both urged him to change from law to theology. Plessis-Mornay, who was chary of laudations, pronounced that "there was nothing above the grasp of his great parts." Returned home, his father, after considerable hesitation, gave consent to the change from law to divinity, with a proviso that he should revise his philological and philosophical studies, and read over Mons. Calvin's *Institutions*, before finally determining. He did so, and, as might have been anticipated, decided for theology. He thereupon removed to Saumur—destined to be forever associated with his name—and "sat at the feet of the great Cameron," who ultimately regarded him as his greatest scholar. He had a brilliant course, and was in due time licensed as a minister of the French Protestant Church. He was appointed to Saumur, and to the professor's chair along with the pastorate. On the occasion of his inauguration he maintained for thesis *De Sacerdotio Christi*. His co-professors were Lewis Capell and Josua de la Place, who were also Cameron's pupils. Very beautiful was the life-long friendship of these three remarkable men. They remain associated still as the joint authors of a body of divinity entitled *Theses Saumurienenses*. Full of energy in every atom of him, Amyraut devoted himself to his labor of love with a fine enthusiasm of love of labor. He very speedily gave French Protestantism a potentiality it had never possessed before. In 1631 he published his *Traité des Religions*, a book that still lives; and from this year onward he was a foremost man in the church, especially at the national and provincial synods. When the king visited Saumur in 1651, Amyraut declined to close his church on the Sunday, but preached a sermon that rang through Europe on the text, "Fear God, honor the king." Amyraut remained to the end one of the most prominent names of French Protestantism; and his *De l'Elevation de la Foi et de l'Abaissement de la Raison en la Créance des Mystères de la Religion* (1641) gave him early a high place as a metaphysician, which was sustained by after works. Exclusive of his controversial writings, he left behind him a very voluminous series of practical evangelical books, which remain the fireside favorites of the peasantry of French Protestantism still. His *État des Fidèles après la Mort* nas comforted many mourners; his *Sur l'Oraison Dominicale* is striking and rich; his *Du Mérite des Œuvres* and *Traité de la Justification*, weighty and powerful; his Paraphrases on Old Testament and New Testament books of Holy Scripture, judicious and suggestive—sometimes penetrative. His closing years were weakened by a severe fall he met with in 1657. He died on 18th January 1664.

ANA, a Latin plural termination appropriated to various collections of the observations and criticisms of eminent men, delivered in conversation and recorded by their friends, or discovered among their papers after their decease. Though the term Ana is of comparatively modern origin, the introduction of this species of composition is not of recent date. It appears, from D'Herbelot's *Bibliothèque Orientale*, that from the earliest periods the Eastern nations were in the habit of preserving the maxims of their sages. From them the practice passed to the Greeks and Romans. Plato and

Xenophon treasured up and recorded the sayings of their master Socrates; and Arrian, in the concluding books of his *Enchiridion*, now lost, collected the casual observations of Epictetus. The numerous apophthegms scattered in Plutarch, Diogenes Laertius, and other writers, show that it was customary in Greece to preserve the colloquially expressed ideas of illustrious men. It appears that Julius Caesar compiled a book of apophthegms, in which he related the *bon mots* of Cicero; and Quintilian informs us that a freedman of that celebrated wit and orator composed three books of a work entitled *De Focis Ciceronis*. We are told by Suetonius that Caius Melissus, originally the slave but afterwards the freedman and librarian of Mæcenas, collected the sayings of his master; and Aulus Gellius has filled his *Noctes Atticæ* with anecdotes which he heard from the eminent scholars and critics whose society he frequented in Rome.

But though vestiges of Ana may be traced in the classical ages, it is only in modern times that they have come to be regarded as constituting a distinct species of composition, comprising literary anecdotes, critical reflections, and historical incidents, mingled with the detail of *bon mots* and ludicrous tales. The term Ana seems to have been applied to such collections as far back as the beginning of the 15th century.

The most remarkable collection of Ana in the English language—and, indeed, in any language—is to be found in a work which does not correspond to the normal type either in name or form. In his *Life of Samuel Johnson, LL.D.*, Boswell relates that to his remark, *à propos* of French literature, "Their Ana are good," Johnson replied, "A few of them are good; but we have one book of that kind better than any of them—Selden's *Table-Talk*." Boswell's own work is incomparably superior to all. In worth as a book this has been rated, on the high authority of Carlyle, beyond any other product of the 18th century, and the value it has depends mainly on its Ana. Its interest arises, not from the details it furnishes of the events of Dr. Johnson's career, still less from any attempt at a discriminating estimate of his work and character, but from the graphic representation it gives of his habitual manner of life and speech. The innate greatness of Johnson appears, more than in all his writings, in his portrait, delineated with the exactness of a sharply defined photograph, as he appeared to the eyes of his admiring biographer in his daily *dishabille*.

ANABAPTISTS (*re-baptisers*), a name sometimes applied indiscriminately to all denominations of Christians that deny the validity of infant baptism, but restricted in general usage to certain sects which became prominent in Germany and elsewhere at the period of the Reformation. In both cases the designation originates with opponents, and is repudiated by the great majority of those to whom it is applied. Believing, as they do, that the baptism of infants is no baptism, they naturally object to a name which implies that their baptism of such persons as may have been baptised in infancy is a second administration of the rite. It is therefore desirable to avoid the use of the term as descriptive of those who hold what are otherwise known as antipædobaptist views. In its more limited sense the word has been too long in use, and is too well known to be now discarded, though it is open to the further objection, in addition to that already stated, that it describes a sect by one of the least important of its distinctive doctrines and practices. The Anabaptists of Germany are historically noteworthy, not because they insisted on re-baptism as the condition of admission to their communion, but because the enthusiasm of the Reformation manifested itself in them in a form and

manner altogether peculiar. Their views as to the true constitution of the church and its relation to the state, and the efforts they made to realize these views, furnish a problem, partly theological, partly historical, of which a satisfactory solution is not easy. There is an obvious genetic, though not historical connection between the the Anabaptists and those earlier sects (Novatians, Donatists, Albigenses, Waldenses) which did not practise infant baptism. It is more important, however, to trace the relation between the Anabaptists and the great body of the Reformers. Anabaptism, as a system, may be defined as the Reformation doctrine carried to its utmost limit; the Anabaptists were the extreme left in the army of the Reformers. The history of the Anabaptist movement in its outward development is brief but eventful. In 1521 their first rising took place at Zwickau, under the leadership of Thomas Münzer, the Lutheran pastor of that place. (See MÜNZER.) Compelled to leave Zwickau, Münzer visited Bohemia, resided two years at Altstadt and Thuringia, and in 1524 spent some time in Switzerland. During this period he proclaimed his revolutionary doctrines in religion and politics with growing vehemence, and, so far as the lower orders were concerned, with growing success. The crisis came in the so-called Peasants' War in South Germany, in 1525. In its origin a revolt against feudal oppression, it became, under the leadership of Münzer, a war against all constituted authorities, and an attempt to establish by force his ideal Christian commonwealth, with absolute equality and the community of goods. The total defeat of the insurgents at Frankenhausen (May 15, 1525), followed as it was by the execution of Münzer and several other leaders, proved only a temporary check to the Anabaptist movement. The Mennonites, have been identified with the earlier Anabaptists, on the ground that they included among their number many of the fanatics of Münster. But the continuity of a sect is to be traced in its principles and not in its adherents, and it must be remembered that Menno and his followers expressly repudiated the distinctive doctrines of the Münster Anabaptists. They have never aimed at any social or political revolution, and have been as remarkable for sobriety of conduct as the Münster sect was for its fanaticism. (See MENNONITES.) In English history frequent reference is made to the Anabaptists during the 16th and 17th centuries, but there is no evidence that any considerable number of native Englishmen ever adopted the principles of the Münster sect. Many of the followers of Münzer and Bockhold seem to have fled from persecution in Germany and the Netherlands to be subjected to a persecution scarcely less severe in England. The mildest measure adopted towards these refugees was banishment from the kingdom, and a large number suffered at the stake. It has already been explained that the application of the term Anabaptist to those English sects that had nothing in common with the German Anabaptists except the practice of adult baptism, is unjustifiable. (See BAPTISTS.)

ANABASIS, a march into the interior; the title given by Xenophon to his narrative of the expedition of Cyrus, the younger against his brother Artaxerxes of Persia, 401 years B.C., and adopted by Arrian for his history of the expedition of Alexander the Great.

ANACHARSIS, a Scythian philosopher, who lived about 600 B.C. Instructed in the Greek language by his mother, he prevailed upon the king to intrust him with an embassy to Athens. On his arrival in that renowned city he became acquainted with Solon, from whom he rapidly acquired a knowledge of the wisdom and learning of Greece. By the influence of Solon he was introduced to the principal persons in Athens, and was the first stranger who received the privileges of

citizenship. According to Herodotus, he was killed by his brother Saulius while he was performing sacrifice to the goddess Cybele. His simple and forcible mode of expression has been called "Scythian eloquence."

ANACHRONISM, a neglect or falsification, whether wilful or undesigned, of chronological relation. Its commonest use restricts it to the ante-dating of events, circumstances, or customs; in other words, to the introduction, especially in works of imagination that rest on a historical basis, of details borrowed from a later age. Anachronisms may be committed in many ways, originating, for instance, in disregard of the different modes of life and thought that characterise different periods, or in ignorance of the progress of the arts and sciences and the other ascertained facts of history, and may vary from glaring inconsistency to scarcely perceptible misrepresentation. Anachronisms abound in the works of Raphael and Shakespeare, as well as in those of the meanest daubers and playwrights of earlier times. The safe and the just course here appears to be to "regard the writer's end," and not to hold an author responsible for historical accuracy or verisimilitude who does not profess to write history.

ANACOLUTHON is the lack of grammatical symmetry in a sentence, either through the consequent taking an unexpected form or being altogether suppressed, the writer or speaker desiring to present his thought in another aspect, or feeling that he has already made his meaning sufficiently plain. In the case of a man who is full of his subject, or who is carried along by the passion of the moment, such inconsequents are very apt to occur.

ANACONDA, a gigantic snake of South America, sometimes over 30 feet in length, called the *water-serpent*, from frequenting swamps and rivers, and preying on water animals.

ANACREON, an Ionian Greek, born at Teos, on the coast of Asia Minor, probably about 562 B.C. His reputation as a lyric poet stood very high both in his own age and those that followed. "The charming"—"the honey-tongued"—"the swan of Teos"—"the glory of Ionia," are some of the epithets constantly given him by ancient writers. "Sing us one of the songs of Alcæus or Anacreon," cries one of the guests in a comedy of Aristophanes. "When I hear the verses of Sappho or Anacreon," says the poet to his friends, in the *Symposium* of Plato, "I set down my cup for very shame of my own performances." Of the poet's life little is known beyond a few scattered notices, not in all cases certainly authentic. He probably shared the voluntary exile of the mass of his fellow-townsmen, who, when Cyrus the Great was laying siege to the Greek cities of Asia, took ship, and founded a colony at Abdera in Thrace, rather than surrender their city to his general Harpagus. From Thrace he soon removed to the island of Samos, ruled at that time by Polycrates, one of the grandest of those old "tyrants" who by no means deserved the name in its worst sense. It is said that he acted as Polycrates's tutor; that he stood very high in his confidence we learn from so good an authority as Herodotus, who represents the poet as sitting in the royal chamber when audience was given to the Persian herald. In return for such favor and protection, he wrote many complimentary odes upon Polycrates and his favorites. But if an anecdote found in Stobæus is true, he was no mercenary flatterer. On one occasion the "tyrant" presented him with the sum of five talents. He spent two wakeful nights in thinking of his money, and then returned it to the giver, saying it "was not worth the care it cost him." On the death of Polycrates, Hipparchus, who was then in power at Athens, and who inherited the literary tastes

of his father Pisistratus, sent a special embassy to fetch the popular poet to Athens in a galley of fifty oars. He must have fully enjoyed and contributed much to the enjoyment of the brilliant circle with which Hipparchus had surrounded himself, and there he made acquaintance, amongst others, with the poet Simonides. When this circle was broken up by the assassination of Hipparchus, Anacreon seems to have returned to his native town of Teos. There, according to a metrical epitaph ascribed to his friend Simonides, he died and was buried. Lucian mentions him amongst his instances of the longevity of eminent men, as having completed eighty-five years. Anacreon had a reputation as a composer of hymns, as well as of those bacchanalian and amatory lyrics which are commonly associated with his name. Two short hymns to Diana and Bacchus, consisting of eight and eleven lines respectively, stand first amongst his few undisputed remains, as printed by recent editors. But pagan hymns, especially when addressed to such deities as Venus, Eros, and Bacchus, are not so very unlike what we call "Anacreontic" poetry as to make the contrast of style so great as the word might seem to imply. The tone of Anacreon's lyric effusions has probably led to an unjust estimate, both by ancients and moderns, of the poet's personal character. As Homer was accused of bibulous propensities by some because he makes frequent and kindly mention of "the purple wine," so Anacreon was held to be a thorough sensualist because he sang so persistently of wine and love.

ANADYOMENE, an epithet of Aphrodite (Venus), expressive of her having risen (*i.e.*, been born) from the foam of the sea. In works of ancient art—*e.g.*, in many existing bronze statuettes—Venus was represented under this title as if just emerged from the sea, and in the act of wringing her tresses.

ANADYR, the name of a gulf and of a river in the north-east of Siberia. The gulf extends from Cape St. Thadeus, on the south, forming part of the Behring Sea; while the river, taking its rise from a lake in the Stanovoi mountains, called Ivashki or Ivachno, flows through the Tchutchee country, at first to the west and then to the east, entering the gulf of Anadyrskaiia, a branch of the gulf of Anadyr, after a course of about 600 miles.

ANÆSTHESIA (sensation), a term in medicine used to describe a state of insensibility to external impressions, either as the result of disease or as induced artificially by the employment of certain substances known as anæsthetics.

In diseases of the brain or spinal cord anæsthesia is an occasional symptom, but in such cases it is usually limited in extent, involving a limb or a definite area of surface of the body. Complete anæsthesia has been observed in persons who were in a state of catalepsy or trance.

The artificial induction of anæsthesia by the use of drugs or the inhalation of vapours is a subject of great interest, both historically and from its practical application to the relief of suffering and the treatment of disease. Although it is mainly owing to the researches of distinguished chemists and physicians of the present century that the employment of anæsthesia has come to occupy a foremost place among remedies, there is abundant evidence to show that it is a practice of great antiquity. Besides the mention by Homer of the anæsthetic effects of nepenthe, and the reference by Herodotus to the practice of the Scythians of inhaling the vapors of a certain kind of hemp to produce intoxication, the employment of anæsthetics in surgery in the use of mandagora is particularly alluded to by Dioscorides and Pliny. It also appears, from old Chinese manuscript laid before the French Academy by

M. Julien, that a physician named Hoa-tho, who lived in the third century, gave his patients a preparation of hemp, whereby they were rendered insensible during the performance of surgical operations. Mandragora was extensively used as an anæsthetic by Hugo de Lucca, who practiced in the thirteenth century. The soporific effects of mandrake are alluded to by Shakespeare, who also makes frequent mention of anæsthetizing draughts, the composition of which is not specified.

As the result of investigations in this department of scientific research, numerous other volatile organic fluids have been found to possess anæsthetic properties. Several of these have been used in surgical practice, but as yet none of them have been found to possess such superiority as would entitle them to supersede chloroform.

ANAGNI, a town of Italy, in the province of Roma, situated on a hill thirty-seven miles east-southeast of Rome.

ANAGRAM, the transposition of the letters of a word or words, is derived from the Greek, which was used in precisely the same sense. But the number of different ways in which even a few letters can be arranged being very great (with eight different letters, for instance, it is $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 = 40,320$), the term anagram is generally restricted to such rearrangements of the letters as form other words, and these usually words which express a meaning.

ANAHUAC, the name of the great central plateau of Mexico, lying at an elevation of from 6,000 to 9,000 feet above the sea. Anahuac comprises three-fourths of the territory of Mexico, including the capital; and although much of its surface is level, many lofty mountains rise out of the table-land, the highest of which is Popocatepetl (17,720 feet), an active volcano.

ANALOGY is the name in logic for a mode of real or material inference, proceeding upon the resemblance between particulars; speaking generally, it is that process whereby, from the known agreement of two or more things in certain respects, we infer agreement in some other point known to be present in the other or others. It was signalized already by Aristotle under the different name of Example, the word Analogy having with him the special sense of mathematical proportion or resemblance (equality) of ratios. The earliest use of the name in its current logical sense is to be found apparently in Galen. While, in popular language, the word has come to be vaguely used as a synonym for resemblance, the logical authorities, though having generally the same kind of inference in view, are by no means agreed as to its exact nature and ground. It has chiefly to be distinguished from the related process of Induction, in their conception of which logicians are notoriously at variance. (See INDUCTION.)

ANALOGY, in *Comparative Anatomy*, is equivalent to "similarity of function." See ANATOMY.

ANALYSIS means literally, in the Greek, an unloosening or breaking-up, understood of anything complex in which simpler constituents or elements may thus be brought to view. It is this general sense that must be supposed to have been present to the mind of Aristotle when he gave the name of *Analytica* to the great logical work in which he sought to break up into its elements the complex process of reasoning; as, accordingly, in the body of the work (*Anal. Prior.* i. 32), we find him once using the verb "analyse" of arguments, when they are to be presented in "figure," or brought to the ultimate formal expression in which they can best be tested or understood. Obviously any more special sense that may be ascribed in the process of analysis must vary with the kind of complex to be resolved. Mental states, material substances, motions

of bodies, relations of figures, are but a few examples of the complex things or subjects that fall to be analyzed, if there is to be any scientific comprehension of them. Nor is it only that the analysis will be into constituents differing from each other as much as the complex subjects differ; for the same subject may be analyzed in different ways, and with very different results, according to the particular aspect in which it is considered. Hence it becomes impossible, or at least very difficult, to describe the process in any terms fitting equally all the variety of its applications. It is from taking stand by some particular application, and either overlooking all others, or trying to force them within the frame of the one, that different writers have given such discrepant accounts of the process—discrepant often to the extent of being mutually exclusive.

I. Mathematical Analysis and Synthesis.—In the *Elements* of Euclid, containing so many examples of geometrical propositions variously established, there is a scholion near the beginning of Book XIII. which distinguishes two general methods for the treatment of particular questions, under the name of Analysis and Synthesis. In analysis, it is said, the thing sought is taken for granted, and consequences are deduced from it which lead to some truth recognized, synthesis, on the other hand, starts from that which is recognized, and deduces consequences therefrom, till the thing sought is arrived at.

II. Chemical Analysis and Synthesis.—After mathematics, chemistry is the science in which application has most expressly been made of processes termed analysis and synthesis. In physics, regarded as the science of motion, whether abstractly taken or as manifested actually in natural bodies, the application is universal; the resolution and composition of velocities, motions, and forces being fundamental processes pervading the whole science under a variety of circumstances. There is nothing, however, in such an employment of analysis and synthesis that is not easily intelligible in the light of the processes as practiced either in the more general science of mathematics, dealing with relations of quantity in number and form, or in the more special science of chemistry, which deals with those characteristic qualities of actual bodies for which no definite expression in terms of motion can be found.

III. Psychological Analysis and Synthesis.—Passing for the next signal application of analysis from the world of matter to mind, we have here a subject which more than any other calls for an exercise of the process in order to be scientifically understood. Physical things in their superficial relations lie to a great extent open to direct apprehension, and whatever deeper connections there may be to be traced out among things the most remote in their nature as apprehended, yet the fact of their separation in space involved in our perception of them is already something done, leaving the scientific function (analytic and synthetic) to be exercised chiefly in the attempt to comprehend them. Very different is the state of affairs in mind, where everything, as it were, runs or melts into everything else. Even to lay hold of particular mental phenomena, with a view to the explanation of them, implies already an express scientific attitude which must be called analytic.

IV. Logical Analysis and Synthesis.—To logic, taken in its widest sense as the methodology of all science, it belongs to appreciate the general import of all such applications of analysis and synthesis as have now been considered. There remains, however, a special variety which is itself entitled logical analysis and synthesis, and which has the more carefully to be distinguished from the other heads, because it stands in opposition to them all.

Logical analysis is the same process as that which is otherwise called metaphysical division. (The process called logical division is different. See LOGIC and DIVISION.) Given, say, a concrete subject like man, this may be divided physically into a number of parts in space, or as a concept, metaphysically into a number of qualities or attributes,—metaphysically, because none of these has an independent substance or physical existence apart. They are distinguished in the way of mental consideration or, as it is technically called, abstraction; and, this being a thought-process or logical act, the resolution of the given complex into such conceptual elements gets the name also of logical analysis. The corresponding act of synthesis proceeds by the way that is technically called determination; thus the general concept man, to take the traditional example, has the attribute of rational joined to the attributes of animal, or is determined by that addition, and much else has to be added in a similar way before the particular concrete can be determined.

ANALYTIC JUDGMENTS have been distinguished under that name, in opposition to Synthetic, since the time of Kant. It was necessary, for the purposes of his critical inquiry into the principles of human knowledge, that he should carefully determine the character of those assertions which metaphysicians had so freely made respecting the supernatural, and he found them to be such that, while the predicate was added on to the subject not involved in it, the connection was affirmed as well as other assertions of like character in mathematics and pure physics, synthetic judgments *à priori*, and the aim of his critical inquiry came to be the determining of the conditions under which such judgments were possible. Now, as differing from these, he noted two classes of judgments: (1), such as in the predicate added indeed to the content of the subject, but only empirically, as, for example, Bodies have weight, and these he called synthetic *à posteriori*; (2), such as were indeed necessary and universal, but added nothing to the content of the subject, as, for example, Bodies are extended, and these he called analytic.

The general distinction of analytic and synthetic judgments has a value apart from the specific character of those (synthetic) judgments in which Kant was most interested, and for the sake of which mainly it was fixed by him. Trained in the metaphysics of the Leibnitz-Wolfian school, which marked off necessary judgments from those of simple fact without considering the kinds of necessity, Kant, when he came, by the route that can be traced in his earlier works, to apprehend the difference between merely logical analysis and real synthesis in thought, applied it almost exclusively to those judgments for which a character of necessity was claimed. He therefore noticed traces of the distinction in other thinkers, as Locke, only in so far as there was a suggestion also of this special reference. In truth, the general distinction, under a variety of expressions, was familiar to both Hume and Locke, and it had already been drawn by the ancients.

ANAM, or ANNAM, also called COCHIN CHINA, a large empire of Asia, forming the eastern portion of the Indo-Chinese peninsula. See COCHIN CHINA.

ANASTASIUS I., Emperor of Constantinople, was born at Dyrrhachium not later than 430 A.D. At the time of the death of Zeno (491), Anastasius, though only one of the guards of the palace, held a very high character, and was raised to the throne of the Roman empire of the East, mainly through the influence of Ariadne, Zeno's widow, whom he married shortly after his accession. For the support he gave to the Eutychians, Anastasius was anathematized by Pope Symmachus. The latter years of his reign were troubled by

revolts in Constantinople, excited by his avarice and by his reputed heretical tendencies. He died in 518.

ANASTASIUS II., Emperor, whose original name was Artemius, was raised to the throne of Constantinople by the voice of the senate and people in 713 A.D., on the deposition of Philippicus, whom he had served in the capacity of secretary. After a six months' reign, Constantinople was taken by Theodosius; and Anastasius, who had fled to Nicæa, was compelled to submit to the new emperor, and retiring to Thessalonica, became a monk (716). In 721 he headed a revolt against Leo, who succeeded Theodosius, and receiving a considerable amount of support, laid siege to Constantinople; but the enterprise failed, and Anastasius falling into Leo's hands, was put to death by his orders.

ANATHEMA (lit. anything offered up), things consecrated to the gods, and deposited in a temple. In the New Testament it signifies separated from the church and accursed, and it became the technical term for a form of excommunication at an early date.

ANATOLIA (the east), a name first used under the Byzantine empire for the country east of the Bosphorus. In the form *Anadoli*, it denotes a modern Turkish division almost coincident with ASIA MINOR (*q.v.*).

ANATOMY (Gr., "a cutting up or dissecting") is the science of the form and structure of organized bodies, and is practically acquired by separation of the parts of a body, so as to show their distinct formation, and their relations to each other. It is therefore a branch of the science of Biology, which consists of two great divisions—the anatomy of animals, styled *Zootomy*, and that of plants, *Phytotomy*. The various divisions of Anatomy will be found at the end of the following historical sketch.

History of Anatomy.—It is difficult to determine the date at which this science began to be cultivated, but it is probable that from the earliest times some persons took advantage of favorable circumstances to acquaint themselves with it. Alcmaeon of Crotona, a disciple of Pythagoras, and Democritus are said to have dissected animals with the view of obtaining comparative knowledge of human anatomy. Hippocrates (*q.v.*), born at Cos about 460 B.C., though the father of medicine is less justly regarded as the father of anatomy, as his views of the structure of the human body are very superficial and incorrect. Aristotle, born 384 B.C., is really the founder of the science. He seems to have based his systematic views of comparative anatomy on the dissection of animals, but does not appear to have dissected men. He first gave the name *aorta* to the great artery. No real progress in human anatomy was made, owing to the researches being confined to animals, till the time of Erasistratus (250 B.C.), who was the first to dissect human bodies—the bodies of criminals. Herophilus also is said to have dissected living subjects. Celsus (53 B.C.) in his *De Medicina* wrote much on anatomy.

Galen (131 A.D.) dissected apes, as being most like human subjects, though he occasionally obtained bodies of persons found murdered; and his writings show a knowledge of human anatomy. Soranus, Oribasius, Nemesius, Meletius, and Theophilus based their anatomical works mainly on Galen. Anatomy made small progress among the Arabs, as their religion prohibited contact with dead bodies. Avicenna (980 A.D.), born in the province of Khorassan, was a good osteologist, and described some structures not alluded to by Galen.

The medical school at Bologna became famous in the thirteenth century, as did also those at Padua and Salerno; but no very material progress was made in anatomy. Mondino, born at Milan, 1315, professed anatomy there, and is considered the real restorer of

anatomy in Italy. Then came Guy de Chauliac, Mathæus de Gradibus (1480), Gabriel Zerbis (1495), Achillini (1512), Berenger of Carpi (1578), Etienne, Massa, and Sylvius (1539). An epoch is made by Andrew Vesalius (*q. v.*), who published a great work on anatomy before he was twenty-eight years of age.

William Horman of Salisbury wrote, in 1530, *Anatomia Corporis Humani*. Thomas Gemini of London, in 1545, engraved upon copper the anatomical figures of Vesalius, which had appeared in Germany upon wood. Gemini suppressed the name of Vesalius, though using his figures and descriptions. Thomas Vicary, in 1548, is said to be the first who wrote in English on anatomy; he published *The Englishman's Treasure, or the True Anatomy of Man's Body*. Franco (1556), Valverde, and Columbus wrote works of great merit on anatomy. In 1561 Gabriel Fallopius (*q. v.*) taught with great distinction at Padua, and made many original discoveries.

In the seventeenth century, progress was rapid. Harvey, in 1619, discovered the circulation of the blood, and the microscope was employed to detect the structure of minute vessels. Aselli, in 1622, discovered and demonstrated the existence of the lymph-vessels. The glandular organs were investigated by Wharton, while Malpighi, Swammerdam, and the illustrious Ruysch, by the use of injections and the aid of the microscope, gave a new impulse to research in the minute structures. Eminent names in the history of anatomy are numerous in the eighteenth century. In Italy, which still retained its former preëminence, we find Pacchioni, Valsalva, Morgagni, Santorini, Mascagni, and Cotunni; in France, Winslow, D'Aventon, Lieutaud, Vicq d'Azyr, and Bichat, the founder of general anatomy; in Germany, Haller and Meckel prepared the way for greater achievements in the nineteenth century; in Great Britain, Cowper, Cheselden, Hunter, Cruikshank, Monro, and Charles Bell contributed to the progress of the science; while Holland was worthily represented by Boerhaave, Albinus, Camper, Sandifort, and Bonn. On the boundaries of the two centuries, we find the names of Sömmerring, Loder, Blumenbach, Hildebrand, Reil, Tiedemann, and Seiler.

The necessity of a union of theory and practice has led to the study of PATHOLOGICAL ANATOMY (the dissection and study of structures as modified by diseases). The origin of this branch of anatomy may be traced back to ancient times in Egypt; and among the Greeks some anatomico-pathological observations are found. During the general revival of science in the sixteenth century, many notices of pathological anatomy occur. Morgagni (1767) must, however, be regarded as the true founder of Pathological Anatomy. He was worthily followed by Lieutaud, Sandifort, Hunter, Baillie, Meckel the younger, and others. The recent change of direction given to the study of Pathological Anatomy, which is now properly regarded as a means toward practical improvements in medicine, must be ascribed to Bichat and the pupils of Broussais, among whom may be mentioned the names of Laennec, Cruveilhier, Louis, Andral, Lobstein, Lebert, Virchow, and Bennett.

Theoretical anatomy is divided into General and Special. GENERAL ANATOMY gives a description of the elementary tissues of which the systems and organs of the body are composed, as preliminary to an examination of them in their combined state in the various organs: it also investigates their laws of formation and combination and the changes which they undergo in various stages of life. This branch of study may also be styled Structural or Analytical Anatomy, and has been first developed in recent times, especially by

Bichat (1801) and Beclard, who have been followed by J. Müller, Goodsir, Henle, E. H. Weber, Schwann, Valentin and many others. In our day, microscopic investigation has been successfully applied to the study of elementary textures. See HISTOLOGY.

SPECIAL ANATOMY (styled Descriptive by the French writers) treats of the several parts and organs of the body in respect to their form, structure, and systematic connection or relation with each other. The arrangement of the several parts and organs in an order deduced from their similarity in structure or use, constitutes SYSTEMATIC ANATOMY.

SPECIAL ANATOMY OF THE HUMAN BODY.

Man, zoologically speaking, belongs to the Mammalian class of the Vertebrate sub-kingdom, *i. e.*, his young are brought forth alive, and nourished during infancy on milk secreted in mammary or milk-forming glands. In common with all vertebrate organisms, he possesses a spine or vertebral column and a skull, in which are contained the brain and the spinal marrow, and on the ventral surface of the spinal column are situated the several subdivisions of the alimentary canal.

But man possesses certain special or distinctive anatomical characters. The most noticeable, as seen on an external inspection of his body, is his erect position. He is, indeed, the only living creature that can walk or stand erect, *i. e.*, with the axis of the spine vertical; with the hip and knee joints capable of being fully extended, so that the leg is brought into line with the thigh; with the foot so planted on the ground that it rests on the heel behind and on the roots of the toes in front; with the upper limbs so arranged as to act, not as instruments of progression, but as prehension; and with the head so balanced on the top of the spine that the face and eyes look directly to the front. His bones, joints, and muscles are constructed and arranged so as to enable him to preserve the erect attitude without fatigue. In other vertebrata the axis of the spine is oblique or horizontal, the hip and knee joints are permanently bent at a more or less acute angle, the limbs corresponding to the human upper extremities, are, in the form of legs, wings, or fins, instruments of progression, and the head is articulated with the spine at or near the hinder end of the skull. Owing to the oblique or horizontal attitude of the body in the vertebrata generally, and its erect position in man, the terms which are employed in describing the relative position of different parts are not used in the same sense by the human and comparative anatomist. Thus, parts which are superior, or above other parts, in the human body, are anterior, or in front, in other vertebrata; and parts which are posterior, or behind other parts in man, are superior to them in other vertebrata. To obviate the confusion which must necessarily arise when comparing the human body with that of other vertebrates, certain descriptive terms have been recommended which may be employed whether the position of the body be erect or non-erect. Thus, the aspect of parts directed toward the region where the atlas or first vertebra is situated is *atlantal*, that directed toward the sacrum is *sacral*, that toward the back is *dorsal*, and that toward the front is *ventral* or *hamal*. Quite recently the term *pre-axial* has been introduced as equivalent to *atlantal*, and *post-axial* to *sacral*.

The body may be considered as divided by an imaginary plane, the *mesial plane*, into two lateral and similar halves, a right and left, so that it exhibits a bilateral symmetry; and the constituent parts are described as being *external* or *internal* to each other, according to their relative position to this plane. For descriptive purposes, also, we may subdivide the body into AXIAL and APPENDICULAR portions. The AXIAL part is the

stock or stem of the body, and consists of the Head, the Neck, and the Trunk. The trunk is again subdivided into the chest or Thorax, and the belly or Abdomen; and the abdomen is again subdivided into the abdomen proper and the Pelvis. The axial part contains the organs essential to the preservation of life. In the head is lodged the brain, from which the spinal marrow is prolonged down the spinal canal. At the sides of the head are the ears, and opening on to the face are the eyes, nostrils, and mouth. Prolonged down the neck are the gullet and windpipe, with the latter of which is associated the organ of voice. Within the chest lie the heart, lungs, and gullet; and in the abdomen are contained the stomach, intestine, liver, spleen, pancreas, kidneys, and other organs concerned in the urinary and generative functions. The APPENDICULAR part forms the limbs, which do not contain organs essential to life. In man the limbs are called Upper and Lower—the former are instruments of prehension, the latter of progression. The subdivisions of the body are not homogeneous in structure, but are built up of several systems of organs, each system being characterized not only by peculiarities in form, appearance, and structure, but by possessing special functions and uses. Thus the bones collectively form the Osseous system; the joints the Articular system; the muscles, which move the bones at the joints, the Muscular system; and these several systems collectively constitute the organs of Locomotion. The blood and lymph vessels form the Vascular system; the brain, spinal marrow, and nerves, the Nervous system, with which is intimately associated the organs of Sense; the lungs and windpipe, the Respiratory system; the alimentary canal, with the glands opening into it, the Digestive system; the kidneys, bladder, and urethra, the Urinary system; the testicles, spermatic ducts, and penis in the male, with the ovaries, uterus, and clitoris in the female, the Generative or Reproductive system; the skin, with the hair and nails, the Tegumentary system. These various systems are so arranged with reference to each other as to form an organic whole.

The organs of locomotion consist of the muscles or active organs, and the bones and joints or passive organs. The word Skeleton signifies literally the dry or hard parts of the body. When used in a limited sense it is applied merely to the bones, but when used in a wider and more philosophic sense it comprises not only the bones or osseous skeleton, but the cartilages and fibrous membranes which complete the framework of the body. The first evidence of a skeleton in the embryo is the appearance of membranes in many parts of which cartilage is developed, and in course of time this cartilage is converted into bone. In some animals, however, as in the cartilaginous fish, the osseous conversion does not take place, and the skeleton remains permanently cartilaginous; and in the very remarkable fish called *Lancelet* or *Amphioxus*, the skeleton consists almost entirely of fibrous membrane.

The skeleton serves as a basis of support for the soft parts, as affording surfaces of attachment for muscles and as a protection for many delicate organs. In the vertebrata the osseous skeleton is clothed by the muscles and skin, and is technically called an *endo-skeleton*. In invertebrata the skeleton is not infrequently on the surface of the body, and is termed an *exo- or dermo-skeleton*. In some vertebrates (e. g., the armadillo, tortoise, and sturgeon), in addition to the proper endo-skeleton, skeletal plates are developed in connection with the integument, so that they possess a dermo-skeleton likewise. In some vertebrates, also, a partial skeleton is formed within the substance of some of the viscera—e. g., in ruminant animals a bone is situated in

the heart; in the walrus and other carnivora, in rodents, bats, and some monkeys, a bone lies in the penis; and in the leopard, jackal, and other carnivora, a cartilaginous style lies in the middle of the tongue. These parts form a *splanchno* or visceral skeleton. By some anatomists the teeth, which are unquestionably hard parts of the body, are also referred to the splanchno-skeleton, though they are special modifications of the papillæ of the mucous membrane of the gum. In man, the teeth being excluded, there is neither exo- nor splanchno-skeleton, but only an endo-skeleton.

In each of the great subdivisions of the body an endo-skeleton exists, so that we may speak of an Axial Skeleton and an Appendicular Skeleton. The Axial Skeleton consists of the bones of the spine and head, the ribs, and the breastbone; the Appendicular Skeleton, of the bones of the limbs. The number of bones in the skeleton varies at different periods of life. In the adult there are about 200, but in the child they are more numerous; for in the process of consolidation of the skeleton certain bones originally distinct become fused together.

The Spine, Spinal or Vertebral Column, chine, or backbone, consists of a number of superimposed bones which are named *Vertebræ*, because they can move or turn somewhat on each other. It lies in the middle of the back of the neck and trunk; has the cranium at its summit; the ribs at its sides, which in their turn support the upper limbs; whilst the pelvis, with the lower limbs, is jointed to its lower end. The spine consists in an adult of twenty-six bones, in a young child of thirty-three, certain of the bones of the spine of the child becoming ankylosed or blended with each other in the adult. These blended bones lose their mobility, and are called *false* *vertebræ*; while those which retain their mobility are the *true* *vertebræ*. In the vertebrata the bones of the spine are arranged in groups, which may be named from their position—*vertebræ* of the neck or cervical; of the chest, dorsal or thoracic; of the loins, lumbar; of the pelvis, sacral; and of the tail, coccygeal or caudal; and the number of *vertebræ* in each group may be expressed in a formula. In man the formula is as follows:— $C_7 D_{12} L_5 S_5 Coc_4 = 33$ bones, as seen in the child; but the five sacral *vertebræ* fuse together into a single bone—the sacrum—and the four coccygeal into the single coccyx. Hence the sacrum and coccyx of the adult are the false, while the lumbar, dorsal, and the cervical are the true *vertebræ*.

The *vertebræ* are irregular-shaped bones, but as a rule have certain characters in common. Each possesses a body and an arch, which inclose a ring, with certain processes and notches. The Body, or Centrum, is a short cylinder, which by its upper and lower surfaces is connected by means of fibro-cartilage with the bodies of the *vertebræ* immediately above and below. The collective series of vertebral bodies forms the great column of the spine. The Arch, also called Neural Arch, because it incloses the spinal marrow or nervous axis, springs from the back of the body, and consists of two symmetrical halves united behind in the middle line. Each half consists of an anterior part or pedicle, and a posterior part or lamina. The Rings collectively form the spinal canal. The Processes usually spring from the arch. The spinous process projects backward from the junction of the two laminae, and the collective series of these processes gives to the entire column the spiny character from which has arisen the term Spine, applied to it. The transverse processes project outward, one from each side of the arch. The articular processes project, two upward and two downward, and are for connecting adjacent *vertebræ* together. The Notches, situated on the upper and lower borders of the pedicles,

form in the articulated spine the intervertebral foramina through which the nerves pass out of the spinal canal.

The vertebræ in each group have characters which especially distinguish them. In man and all mammals, with few exceptions, whatever be the length of the neck, the Cervical Vertebræ are seven in number. The exceptions are the three-toed sloth, which has nine, and Hoffmann's sloth and the manatee, in which there are only six. In many whales the seven cervicals are fused in the adult into a single bone. In man the body of a cervical vertebra is comparatively small, and its upper surface is transversely concave; the arch has long and obliquely sloping laminae; the ring is large and triangular; the spine is short, bifid, and horizontal; the transverse process consists of two bars of bone, the anterior springing from the side of the body, the posterior from the arch, and uniting externally to inclose a foramen, through which, as a rule, the vertebral artery passes; the articular processes are flat and oblique, and the upper pair of notches are deeper than the lower.

The Dorsal Vertebræ, more appropriately called costal or thoracic, are twelve in number in the human spine; but among mammals they range from eleven in the armadillo to twenty-two in the Cape hyrax and Hoffmann's sloth. They are intermediate in size and position to the cervical and lumbar vertebræ, and are all distinguished by having one or two smooth surfaces on each side of the body for articulation with the head of one or two ribs.

The Lumbar Vertebræ in man are five in number, but among mammals they range from two in the platypus to eight in the hyrax or agouti. They are the lowest of the true vertebræ, and also the largest, especially in the body.

The Sacrum is composed of five originally separate vertebræ fused into a single bone. The relative size and completeness of the sacrum are associated with the development of the haunch bones and of the lower limbs. It forms the posterior wall of the pelvis, is triangular in form, and possesses two surfaces, two borders, a base, and an apex. By its borders the sacrum is articulated with the haunch-bones—by its base with its last lumbar vertebra, by its apex with the coccyx. The human sacrum is broader in proportion to its length than in other mammals; this great breadth gives solidity to the lower part of the spine, and, conjoined with the size of the lateral articular surfaces, it permits a more perfect junction with the haunch-bones, and is correlated with the erect position. Owing to the need in woman for a large pelvis, the sacrum is broader than in man.

The Coccyx consists of only four vertebræ in the human spine. It is the rudimentary tail, but instead of projecting back, as in mammals generally, is curved forward, and is not visible externally, an arrangement which is also found in the anthropoid apes and in Hoffmann's sloth.

The human spine is more uniform in length in persons of the same race than might be supposed from the individual differences in stature, the variation in the height of the body in adults being due chiefly to difference in the length of the lower limbs. The average length of the spine is twenty-eight inches; its widest part is at the base of the sacrum, from which it tapers down to the tip of the coccyx. It diminishes also in breadth from the base of the sacrum upward to the region of the neck.

The THORAX, PECTUS, or CHEST is a cavity or inclosure, the walls of which are in part formed of bone and cartilage. Its skeleton consists of the sternum in front, the twelve dorsal vertebræ behind, and the twelve ribs, with their corresponding cartilages, on each side.

The Sternum or Breast Bone is an elongated bone which inclines downward and forward in the front wall of the chest. It consists of three parts—an upper, called manubrium or præ-sternum; a middle, the body or meso-sternum; and a lower, the ensiform process or xiphisternum.

The Ribs or Costæ, twenty-four in number, twelve on each side of the thorax, consist not only of the bony ribs, but of a bar of cartilage continuous with the anterior end of each bone, called a *costal cartilage*, so that they furnish examples of a cartilaginous skeleton in the adult human body; in aged persons these cartilages usually become converted into bone. The upper seven ribs are connected by their costal cartilages to the side of the sternum, and are called *sternal* or *true* ribs; the lower five do not reach the sternum, and are named *a-sternal* or *false*, and of these the two lowest, from being comparatively unattached in front, are called *free* or *floating*. All the ribs are articulated behind to the dorsal vertebræ, and as they are symmetrical on the two sides of the body, the ribs in any given animal are always twice as numerous as the dorsal vertebræ in that animal. They form a series of osseo-cartilaginous arches, which extend more or less perfectly around the sides of the chest. A rib is an elongated bone, and as a rule possesses a head, a neck, a tubercle, and a shaft. The ribs slope from their attachments to the spine, at first outward, downward and backward, then downward and forward, and where the curve changes from the backward to the forward direction an *angle* is formed on the rib. The ribs are by no means uniform in length; they increase from the first to the seventh or eighth, and then diminish to the twelfth; the first and twelfth are therefore the shortest ribs. The first and second costal cartilages are almost horizontal, but the others are directed upward and inward.

In its general form the chest may be likened to a truncated cone. It is rounded at the sides and flattened in front and behind, so that a man can lie either on his back or his belly. Its truncated apex slopes downward and forward, is small in size, and allows of the passage of the windpipe, gullet, large veins, and nerves into the chest. The base or lower boundary of the cavity is much larger than the apex, slopes downward and backward, and is occupied by the diaphragm, a muscle which separates the chest from the cavity of the abdomen. The transverse diameter is greater than the antero-posterior, and the antero-posterior is greater laterally, where the lungs are lodged, than in the mesial plane, which is occupied by the heart.

The HEAD forms the summit of the axial part of the body. It consists of two portions—the Cranium and the Face.

The SKULL, or skeleton of the head, is composed of twenty-two bones, eight of which form the skeleton of the cranium, fourteen that of the face. Except the lower jaw, which is movable, the bones are all firmly united by immovable joints. The eight bones of the cranium are so united together by their edges as to form the walls of a box or cavity, the cranial cavity, in which the brain is lodged. The box of the cranium possesses a base or floor, a vault or roof, an anterior, a posterior, and two lateral walls. The posterior wall is formed by the *occipital* bone, which also extends for some distance forward along the middle of the base; in front of the basal part of the occipital is the *sphenoid*, which also sends a process upward on each side of the skull; in front of the basal part of the sphenoid is the *ethmoid*; mounting upward in front of the ethmoid is the *frontal*, which forms the forehead, and closes in the front of the cranial box; forming the vault and side walls are the two *parietal* bones; completing the

side walls, and extending for a short distance along the side of the floor, are the two *temporal* bones; the *vertex* of the skull is at the junction of the two parietal bones with each other. The fourteen bones of the face, which are situated below and in front of the cranium, enter into the formation of the walls of cavities which open on the front of the face; thus they complete, along with the frontal, sphenoid, and ethmoid, the walls of the two orbits in which the *e-balls* are lodged; along with the ethmoid and sphenoid, the walls of the nostrils; and they form the osseous walls of the mouth. As a general rule, the cranial bones are expanded, and plate-like in form. The margins of the bones are denticulated, and it is by the interlocking of the denticulations of adjacent bones that they are jointed together, the joints being named *sutures*. The bones are pierced by holes or foramina, and similar holes exist between the adjacent margins of some of the bones. These foramina are mostly situated in the floor of the skull, and transmit arteries into the cranial cavity to supply the brain and the inner table with blood, and veins and nerves out of the cavity. The largest of these holes is called *foramen magnum*. It lies in the occipital bone, immediately above the ring of the atlas; through it the spinal marrow becomes continuous with the brain, and the vertebral arteries pass to supply the brain with blood.

The fourteen bones of the Face are, as a rule, much smaller than those of the Cranium; some have the form of thin scales, others are more irregular in shape. They are named as follows:—Two superior maxillary, two palatine, two malar, two nasal, two lachrymal, two inferior turbinal, a vomer, and an inferior maxilla.

In its general form the Skull is ovoid, with the long axis extending antero-posteriorly, the frontal and occipital ends rounded, and the sides somewhat flattened. Its average length in the people of the British Islands is a little more than 7 inches; its greatest breadth about $5\frac{1}{2}$ inches; and its height, from the plane of the foramen magnum to the vertex, about $5\frac{1}{4}$ inches. Its greatest circumference is about 21 inches. The breadth of the face across the zygomatic arches is about 5 inches. The average capacity of the brain cavity is 92 cubic inches.

The nostrils open on the front of the face by a large opening situated between the two superior maxillæ, and bounded above by the two nasals. The sides of the opening pass down almost vertically to join the floor, and are not rounded off as in the ape's skull; from the center of the floor a sharp process, the *nasal spine* of the superior maxillæ projects forward, and forms a characteristic feature of the human skull. Attached to the sides of the opening are the lateral cartilages of the nose, which form the wings of the nostrils, and so modify the positions of their openings that in the face they look downward.

The skull varies in appearance at different periods of life. In infancy the face is small, about one-eighth of the size of the entire head, for the teeth are still rudimentary and the jaws are feeble; the centers of ossification of the cranial bones are prominent; the forehead projects; the skull is widest at the parietal eminences; the air sinuses, and bony ridges corresponding to them, have not formed. In the adult the face is about half the size of the head and its vertical diameter greatly elongated, from the growth of the antrum, the nose, and the dental borders of the jaws; and the angle of the lower jaw is almost a right angle. In old age the teeth fall out, the jaws shrink in, their dental borders become absorbed; the angle of the lower jaw, as in infancy, is obtuse; the vertex and floor of the skull also become flattened, and the sides bulge outward,—

changes due to the gravitation and the subsidence of the bones by their own weight.

The skull of a woman is smaller and lighter, with the muscular ridges and projections due to the air sinuses less strongly marked than in a man, but with the eminences or centers of ossification more prominent. The more feeble air sinuses imply a more restricted respiratory activity and a less active mode of life than in a man. The internal capacity is about 10 per cent less than that of the male. The face is smaller in proportion to the cranium; the cranium is more flattened at the vertex, and the height is consequently not so great in proportion to the length as in the man. In the female skull, therefore, the infantile characters are less departed from than is the case in the male.

Turning now to the APPENDICULAR SKELETON, we shall consider first that of the SUPERIOR or THORACIC PECTORAL EXTREMITY, or UPPER LIMB. The Upper Limb may be subdivided into a proximal part or shoulder, a distal part or hand, and an intermediate shaft, which consists of an upper arm or *brachium*, and a forearm or *anti-brachium*. In each of these subdivisions certain bones are found; in the shoulder, the clavicle and scapula; in the upper arm, the humerus; in the forearm, the radius and ulna, the bone of the upper arm in man being longer than the bones of the forearm; in the hand, the carpal and metacarpal bones and the phalanges. The scapula and the clavicle together form an imperfect bony arch, the Scapular Arch or Shoulder Girdle; the shaft and hand form a free divergent Appendage. The shoulder girdle is the direct medium of connection between the axial skeleton and the divergent part of the limb; its anterior segment, the clavicle, articulates with the upper end of the sternum, while its posterior segment, the scapula, approaches, but does not reach, the dorsal spines. The Clavicle, or Collar Bone is an elongated bone which extends from the upper end of the sternum horizontally outward, to articulate with the acromion process of the scapula. The Scapula, or Shoulder Blade, is the most important bone of the shoulder girdle, and is present in all mammals. It lies at the upper and back part of the wall of the chest, reaching from the second to the seventh rib. Its form is plate-like and triangular, with three surfaces, three borders, and three angles.

The Humerus, or bone of the Upper Arm, is a long bone, and consists of a shaft and two extremities. The upper extremity of this bone possesses a convex spheroidal smooth surface, the *head*, for articulation with the glenoid fossa of the scapula; it is surrounded by a narrow constricted *neck*, and where the neck and shaft become continuous with each other, two processes or *tuberosities* are found, to which are attached the rotator muscles arising from the scapular fossæ. Between the tuberosities is a groove in which the long tendon of the biceps rests.

Before describing the two bones of the forearm, the anatomist should note the range of movement which can take place between them. In one position, which is called *supine*, they lie parallel to each other, the radius being the more external bone, and the palm of the hand being directed forward; in the other or *prone* position the radius crosses obliquely in front of the ulna, and the palm of the hand is directed backward. Not only the bones of the forearm, but those of the hand are supposed to be in the supine position when they are described. The Radius is the outer bone of the Forearm, and like all long bones possesses a shaft and two extremities. The upper extremity or *head* has a shallow, smooth cup for moving on the capitellum of the humerus; the outer margin of the cup is also smooth, for articulation with the ulna and annular ligament; below

the cup is a constricted *neck*, and immediately below the neck a *tuberosity* for the insertion of the biceps. The *Ulna* is also a long bone. Its upper end is subdivided into two strong processes by a deep fossa, the *greater sigmoid cavity*, which possesses a smooth surface for articulation with the trochlea of the humerus. The *Hand* consists of the *Carpus* or wrist, of the *Metacarpus* or palm, and of the free *Digits*, the thumb and four fingers. Anatomists describe it with the palm turned to the front, and with its axis in line with the axis of the forearm. The *Carpal* or *Wrist* bones are eight in number and small in size. The *Metacarpal* bones, or bones of the *Palm* of the *Hand*, are five in number. They are miniature long bones, and each possesses a shaft and two extremities. The number of *Digits* in the hand is five, which is the highest number found in the mammalia. They are distinguished by the names of *pollex* or thumb, and *index*, *middle*, *ring*, and *little* fingers. Their skeleton consists of fourteen bones, named *phalanges*, of which the thumb possesses two, and each of the four fingers three.

The *Inferior* or *Pelvic Extremity*, or *Lower Limb*, consists of a proximal part or *haunch*, a distal part or *foot*, and an intermediate shaft subdivided into *thigh* and *leg*. Each part has its appropriate skeleton: in the *haunch*, the *pelvic* or *innominate* bone; in the *thigh*, the *femur*; in the *leg*, the *tibia* and *fibula* (the *thigh-bone* in man being longer than the *leg-bones*); in front of the *knee*, the *patella*; in the *foot*, the *tarsal* and *metatarsal* bones and *phalanges*. The bone of the *haunch* forms an *arch* or *Pelvic Girdle*, which articulates behind with the side of the *sacrum*, and arches forward to articulate with the opposite *haunch-bone* at the *pubic symphysis*. It is the direct medium of connection between the *axial skeleton* and the *shaft* and *foot*, which form a free divergent *Appendage*. The *Os Innominatum*, or *Haunch-bone*, is a large irregular plate-like bone, which forms the lateral and anterior boundary of the cavity of the *pelvis*. In early life it consists of three bones—*ilium*, *ischium*, and *pubis*—which unite about the twenty-fifth year into a single bone. These bones converge, and join to form a deep fossa or cup, the *acetabulum* or *otylod cavity*, on the outer service of the bone, which lodges the head of the *thigh-bone* at the *hip-joint*. The *ilium* in man is a broad plate-like bone. In its most simple form, as in the *kangaroo*, it is a three-sided, prismatic, rod-like bone, one end of which enters into the formation of the *acetabulum*, while the other is free, and forms the *iliac crest*. In man, notwithstanding its expanded form, three surfaces may also be recognized, corresponding to the surfaces in the *ilium* of the *kangaroo*; and, as in that animal, the lower end aids in forming the *acetabulum*, while the upper end forms the *iliac crest*, which, in man, in conformity with the general expansion of the bone, is elongated into the sinuous crest of the *ilium*. This crest is of great importance, for it affords attachment to the broad muscles which form the wall of the *abdominal cavity*.

The *Pubis* is also a three-sided, prismatic, rod-like bone, the fundamental form of which is obscured by the modification in shape of its inner end. In human anatomy it is customary to regard it as consisting of a *body* and of two branches, a *horizontal* and a *descending ramus*.

The *ischium*, like the *ilium* and *pubis*, has the fundamental form of a three-sided prismatic rod. One extremity (the upper) completes the *acetabulum*, while the lower forms the large prominence, or *tuber ischii*. The surfaces of the bone are *internal* or *pelvic*, *external* and *anterior*. The *pelvic* and *external* surfaces are separated from each other by a sharp border, on

which is seen the *ischial spine*. The *pelvic* and *anterior* surfaces are separated by a border, which forms a part of the boundary of the *obturator foramen*; but the margin between the *external* and *anterior* surfaces is feebly marked.

By the articulation of the two *innominate bones* with each other in front at the *pubic symphysis*, and with the sides of the *sacrum* behind, the osseous walls of the cavity of the *PELVIS* are formed. This cavity is subdivided into a false and a true *pelvis*. The false *pelvis* lies between the expanded wing-like portions of the two *ilia*. The true *pelvis* lies below the two *pectineal lines* and the base of the *sacrum*, which surround the upper orifice or brim of the true *pelvis*, or *pelvic inlet*; while its lower orifice or outlet is bounded behind by the *coccyx*, laterally by the *ischial tuberosities*, and in front by the *pubic arch*. In the erect attitude the *pelvis* is so inclined that the plane of the brim forms with the horizontal plane an angle of from 60° to 65° . The axis of the cavity is curved, and is represented by a line drawn perpendicularly to the planes of the brim, the cavity, and the outlet; at the brim it is directed upward and forward, at the outlet downward and a little forward. Owing to the inclination of the *pelvis*, the base of the *sacrum* is nearly four inches higher than the upper border of the *pubic symphysis*. The female *pelvis* is distinguished from the male by certain sexual characters. The bones are more slender, the ridges and processes for muscular attachment more feeble, the breadth and capacity greater, the depth less, the *ilia* more expanded, giving the greater breadth to the hips of a woman than a man; the inlet more nearly circular, the *pubic arch* wider, the distance between the *tuberosities* greater, and the *obturator foramen* more triangular in the female than in the male. The greater capacity of the woman's than the man's *pelvis* is to afford greater room for the expansion of the uterus during pregnancy, and for the expulsion of the child at the time of birth.

The *Femur* or *Thigh-bone* is the longest bone in the body, and consists of a shaft and two extremities. The upper extremity or *head* possesses a smooth convex surface, in which an oval roughened fossa, for the attachment of the inter-articular ligament of the hip, is found; from the head a strong elongated *neck* passes downward and outward to join the upper end of the shaft; the place of junction is marked by two processes or *trochanters*; the *external* is of large size, and to it are attached many muscles; the *internal* is much smaller, and gives attachment to the *psaos* and *iliacus*. A line drawn through the axis of the head and neck forms with a vertical line drawn through the shaft an angle of 30° ; in a woman this angle is less obtuse than in a man, and the obliquity of the shaft of the *femur* is greater in the former than in the latter.

The *Patella* or *Knee-pan* is a small triangular flattened bone developed in the tendon of the great extensor muscles of the leg. Its anterior surface and sides are rough, for the attachment of the fibers of that tendon; its posterior surface is smooth, and enters into the formation of the *knee-joint*.

Between the two bones of the leg there are no movements of pronation and supination as between the two bones of the forearm. The *tibia* and *fibula* are fixed in position; the *fibula* is always *external*, the *tibia* *internal*.

The *Tibia* or *Shin-bone* is the larger and more important of the two bones of the leg; the *femur* moves and rests upon its upper end, and down it the weight of the body in the erect position is transmitted to the foot. Except the *femur*, it is the longest bone of the skeleton, and consists of a shaft and two extremities. The *Fibula*, or *Splint-bone* of the leg, is a slender long

bone with a shaft and two extremities. The upper end or head articulates with the outer tuberosity of the tibia. The Foot consists of the Tarsus, the Metatarsus, and the five free Digits or Toes, which is the maximum number found in mammals. The human foot is placed in the prone position, with the sole or plantar surface in relation to the ground, the dorsum or back of the foot directed upward; the axis of the foot at about a right angle to the axis of the leg; and the great toe or hallux, which is the corresponding digit to the thumb, at the inner border of the foot. The human foot, therefore, is a pentadactylous, plantigrade foot.

The bones of the Tarsus, or Ankle, are seven in number, and are arranged in two transverse rows,—a proximal, next the bones of the leg, consisting of the astragalus, os calcis, and scaphoid; a distal, next the metatarsus, consisting of the cuboid, ectro-, meso-, and ento-cuneiform. The Metatarsal bones and the Phalanges of the toes agree in number and general form with the metacarpal bones and the phalanges in the hand. The bones of the great toe or hallux are more massive than those of the other digits, and this digit, unlike the thumb or pollex, does not diverge from the other digits, but lies almost parallel to them.

A JOINT or ARTICULATION is the junction or union of any two adjacent parts of the body. Most usually the term is employed to signify the connection established between contiguous bones. It is by the joints that the various bones are knit together to form the skeleton. Joints may be either *immovable* or *movable*.

The immovable joints are divided into the *synchondroses* and the *sutures*. A *synchondrosis* is the junction of two bones by the interposition of an intermediate plate of cartilage, the fibrous membrane or periosteum which invests the bones being prolonged from one bone to the other over the surface of the cartilage. A *suture* is the connection of two bones by the interlocking of adjacent toothed margins.

The MUSCLES are the organs which by their contraction or shortening move the bones on each other at the joints. The muscles constitute the flesh of the body. They are so arranged as to be capable not only of moving the various bones on each other, but the entire body from place to place. Hence the muscles are organs both of motion and locomotion. As they can be brought into action at the *will* of the individual, they are called voluntary muscles. Some of the muscles are engaged in the movement of other structures than the bones, such as the eye-ball, tongue, cartilages of the larynx, etc. About 400 muscles are usually enumerated, and the names applied to them express either their position, or relative size, or shape, or direction, or attachments, or mode of action. The word muscle is itself derived from the Latin *musculus*, a little mouse, from a fancied resemblance between that animal and some of the most simply formed muscles. It is customary to distinguish in a muscle a central part, or *belly*, and two extremities, one of which is the *head*, or the *origin*, the other the *insertion*. Entering the substance of each muscle is at least one artery, which conveys blood for its nutrition; this artery ends in a network of capillary blood-vessels, from which a vein arises and conveys the blood out of the muscle again; another small vessel, called a lymphatic, also arises within the muscle, and conveys the fluid lymph out of the muscle. Each muscle is also penetrated by a nerve, through which it is brought into connection with the brain, so as to be subject to the influence of the will. The will is the natural stimulus for exciting muscular action, which action is in many cases so rapid that scarcely an appreciable interval of time intervenes between willing and doing the action.

The bones form a series of rod-like levers, and, in studying the mode of action of the muscles, the place of insertion of the muscle into the bone—that is to say, the point of application of the power which causes the movement—and its relations to the joint, or fulcrum, or center of motion, and to the weight or resistance which is to be overcome, have to be kept in view. The relative positions of fulcrum, point of application of power, and resistance are not the same in all the bony levers. As a rule, the muscles are inserted into bones between the fulcrum and the movable point of resistance, and nearer the fulcrum than the movable point, as may be seen in the muscles which bend the fore-arm at the elbow-joint. Although from the weight-arm of the lever being in these cases much longer than the power-arm, the muscles, as regards the application of the power, act at a disadvantage, yet the movement gains in velocity. Sometimes the muscle is inserted, as is the case in the great muscle which straightens or extends the fore-arm, at one end of the lever, and the fulcrum or joint is placed between it and the movable point. At other times, as in the case of the chief depressor muscle of the lower jaw, while the muscle is attached to one end of the lever, the fulcrum is at the opposite end. When a muscle is so placed that its tendon of insertion is perpendicular to the bone to which it is attached, it acts to great advantage; when placed obliquely or nearly parallel, a loss of power occurs. Many muscles at the commencement of contraction lie obliquely to the bones which they move, but as contraction goes on they become more nearly perpendicular, so that they act with more advantage near the close than at the commencement of contraction. If a muscle passes over only one joint, it acts on that joint only; but if it passes over two or more joints, it acts on them in succession, beginning with the joint next the point of insertion. A given movement may be performed by the contraction of a single muscle, but as a rule two or more muscles are associated together, and they are not infrequently so arranged that one muscle initiates the movement, which is then kept up and completed by the rest. Muscles producing movement in one direction have opposed to them muscles which by their contraction effect the opposite movement; when both groups act simultaneously and with equal force, they antagonize each other, and no motion is produced; when a muscle is paralyzed or divided, its antagonistic muscle draws and permanently retains the part to its own side. The rapidity of action of a muscle is proportioned to the length of its fasciculi, its power of contraction to their number.

The *Intervertebral Joints* are complex in construction. The bodies of the true vertebræ are connected together by an amphiarthrodial joint: the fibro-cartilaginous plate or intervertebral disc is tough and fibrous in its peripheral part, but soft and pulpy within. The joints between the atlas and axis, and the atlas and occiput, are specially modified in connection with the movements of the head on the top of the spine. The intervertebral discs are absent, and the range of movement either from before backward, as in nodding the head, or from side to side, as in looking over the shoulder, is more extensive than that between any of the other true vertebræ. The head rotates along with the atlas around the odontoid or pivot process of the axis, which is lodged between the anterior part of the atlas and a strong transverse ligament which lies behind the odontoid. Too great movement to one side or the other is prevented by the check ligaments, which pass from the top of the odontoid to the occipital bone, in front of the foramen magnum. The nodding movements take place between the occiput and atlas, and are

permitted by the size and shape of the occipital condyles and hollow upper articular surfaces of the atlas. The elasticity of the spine is partly due to the numerous diarthrodial joints between its articular processes, but more especially to the discs of fibro-cartilage interposed between the bodies of the vertebræ, which act like elastic pads or buffers to prevent shock. The spine and trunk may be bent either forward or backward, or to the right or left side; or without being bent, the spine may be screwed to the right or to the left, the screwing movement being permitted by the oblique direction of the articular processes.

The muscles which move the vertebræ on each other are principally situated on the back of the trunk. In the hollow on each side of the vertebral spines lies the great erector spinæ muscle, the fibers of which pass longitudinally upward. When both muscles act together, the entire spine is bent back; but when the muscle of one side only contracts, then the spine is bent to that side. These muscles also act in raising the spine from the bent to the erect position, and they are assisted by small inter-spinal muscles, situated between the spines in the cervical and lumbar regions. The spine is bent forward by the *psosæ* and *longi colli* muscles; and the straight muscles of the abdomen, inserted into the lower true ribs, assist in this movement. The screwing movements of the spine are effected by a series of muscles, the fibers of which pass obliquely between the laminae and spines of adjacent vertebræ, and are known as the *semispinales*, *multifidi*, and *rotatores spinæ* muscles.

The head is balanced on the summit of the spine, and is maintained in a quiescent position without any appreciable muscular action, but it can be moved in various directions by the muscles inserted into its bones. The nodding movements of the head on the atlas are due to the posterior recti, the two superior obliques, the two splenii, and the two complexus muscles, which draw it backward, and the anterior recti and sterno-cleido-mastoid muscles, which draw it forward. In the formation of the walls of the abdomen proper, bones and joints play but a small part. The lumbar vertebræ behind, the expanded wings of the iliac bones below, and the false ribs above are the only bones to be considered. Three pairs of greatly expanded muscles—the external oblique, internal oblique, and transverse—lie at the sides and in front, and two pairs of muscles—the recti and pyramidales—are situated wholly in front. The entire arrangement is admirably adapted for completing the walls of the great abdominal chamber, and for enabling the muscles to compress the abdominal viscera, an action which takes place when the contents of the bowels and bladder are being expelled during defecation and micturition.

Bones and joints play a more important part in the formation of the walls of the thoracic than of the abdominal cavity. Not only are there thoracic vertebræ behind, and the sternum in front, but on each side the twelve ribs arch more or less completely forward from the spine; each rib is articulated behind to one or two vertebræ, and the seven upper ribs, through their costal cartilages, articulate with the sternum.

The *Costo-vertebral Joints* are situated between the head of the rib and the vertebral body; also, except in the floating ribs, between the tubercle of the rib and the transverse process of the vertebra, the joints being diarthrodial, and completed in the usual manner by ligaments and synovial membrane. The *Costo-sternal Joints* are also diarthrodial (except the first costal cartilage, which is directly united to the præ-sternum), a capsular ligament, lined by a synovial membrane, connecting the cartilages of the true ribs to the sternum.

The cartilages from the sixth to the ninth ribs are also united by ligamentous fibers.

The movements of the ribs and sternum at the costo-vertebral and costo-sternal joints are of the utmost importance in the process of breathing. Breathing or respiration consists of two acts—breathing in, or inspiration, and breathing out, or expiration. During inspiration, the air rushes through the nose or mouth down the windpipe, and dilates the air-cells of the lungs; together with the expansion of the lungs the walls of the chest rise, so that the capacity both of lungs and chest at the end of a full inspiration is nearly doubled. During inspiration the following changes occur in the walls of the chest: the ribs are elevated and rotated, the lower borders of their shafts are everted, while their surfaces are at the same time rendered more oblique, and the width of the intercostal spaces is thereby increased; the elevation and rotation of the ribs throw the sternum upward and forward, and make the thoracic part of the spinal column straighter; the diaphragm is depressed, and the antero-lateral walls of the abdomen are thrown forward.

The *Temporo-maxillary Joints* are the only diarthrodial articulations in the head. The movements of the lower jaw take place simultaneously at both its articulations during mastication and speech, through the action of the several muscles which are inserted into it. The elevators of the jaw are much more powerful than the depressors, for they not only have to overcome the weight of the bone, but during mastication have to exercise force sufficient to cut or break down the food between the teeth. In carnivorous animals, more especially those which, like the tiger or hyena, crack the bones of their prey, these muscles attain a great size. The lower jaw can be projected in front of the upper by the external pterygoid muscles, inserted into the neck of the bone on each side; but excessive movement forward is checked by the action of the stylo-maxillary ligaments, which pass from the styloid processes to the angles of the bone; when projected forward, the jaw is drawn back by the posterior fibers of the temporal muscles. When the elevator, depressor, protractor, and retractor muscles are successfully brought into action, the lateral or grinding movements of the bone, so important in mastication, are produced.

Numerous muscles are situated immediately beneath the skin of the scalp and face. They are not so deep red a color as the muscles of the trunk and limbs, and while they arise from one or other of the bones of the head, they are inserted into the deep surface of the skin itself. Hence when they contract they move the skin of the scalp and face, and as they are the instruments through which the various passions and emotions are expressed, they are grouped together as the *Muscles of Expression*.

The cavity of the mouth forms the commencement of the alimentary canal, and is lined by a soft mucous membrane. In it the teeth and tongue are situated, and into it the secretion called saliva is poured. It opens behind into the pharynx. The side walls of the mouth are called the cheeks, and into the formation of each cheek a flattened quadrilateral muscle, the buccinator, enters. This muscle is attached above and below to the upper and lower jaw-bones, behind to a fibrous band, to which the upper constrictor muscle is also connected, so that the walls of the mouth and pharynx are continuous with each other, while in front the buccinator blends with the structures in the lips. It compresses the cheeks, and drives the air out of the cavity of the mouth as in playing a wind instrument; hence the name "trumpeter's muscle."

The aperture of communication between the mouth

and pharynx is named the *isthmus of the fauces*. It is bounded below by the root of the tongue, on each side by the tonsils, and above by the soft palate. The soft palate is a structure which hangs pendulous from the posterior edge of the hard bony palate. From its center depends an elongated body, the *uvula*, and from each of its sides two folds extend, one downward and forward to the tongue, the other downward and backward to the pharynx. These folds are called the anterior and posterior pillars of the fauces or palate. Between the anterior and posterior pillar, on each side, the tonsil is seated. The soft palate and its pillars are invested by the mucous lining of the mouth and pharynx, and contain small but important muscles. The muscles of the soft palate and uvula, termed the elevators and tensors, raise and make them tense during the process of deglutition. The muscles of the posterior pillars, or palato-pharyngei, by their contraction, approximate the walls of the pharynx to the soft palate and uvula, while the muscles of the anterior pillars, or palato-glossi, diminish the size of the fauces.

The pharynx is a tube with muscular walls, lined by a mucous membrane, which communicates above and in front with the cavities of the nose, mouth, and larynx, while below it is continuous with the esophagus or gullet. It serves as a chamber or passage down which the food goes from the mouth to the esophagus in the act of swallowing, and through which the air is transmitted from the nose or mouth to the larynx in the act of breathing. It lies immediately behind the nose, mouth, and larynx, and in front of the five upper cervical vertebrae. Its length is from four and one-half to five and one-half inches; its widest part is opposite the back of the mouth. The principle muscles in its walls are called the constrictors, and are named, from above downward, superior, middle, and inferior.

The action of the muscles of the mouth, palate, and pharynx may now be considered in connection with the process of deglutition or swallowing. When the food is received into the mouth, it is moistened by the secretion of the salivary and other buccal glands, and is broken down by the grinding action of the molar teeth. The buccinator muscles press it from between the gums and the cheek, and, along with the movements of the tongue, aid in collecting it into a bolus on the surface of that organ. During the process of mastication the palato-glossi contract so as to close the fauces. As both the nose and larynx open into the pharynx, the one immediately above, the other immediately below, the orifice of the mouth, it is of great importance that none of the food should enter into these chambers, and obstruct the respiratory passages. To guard against any accident of this kind, two valvular structures are provided,—viz., the soft palate and the epiglottis,—which, while leaving the orifices into their respective chambers open during breathing, may effectually close them when deglutition is being performed. As the bolus is being projected through the fauces into the pharynx, the soft palate and uvula are elevated and made tense, and at the same time the wall of the pharynx is brought in contact with it by the contraction of the palato-pharyngei; the part of the pharynx into which the nose opens is thus temporarily shut off from that into which the mouth opens. If laughter, however, be excited at this time, the tension of the soft palate is destroyed, and part of the food may find its way upward into the nose. The closure of the larynx by the epiglottis is due partly to the depression of that valve and partly to the elevation of the larynx. The backward heave of the tongue relaxes the ligaments which connect the front of the epiglottis to that organ, and enables the small epiglottidean muscles to depress the

valve. The aperture of the larynx is brought into contact with the depressed epiglottis, which is adapted more exactly to the opening by a change in its form due to the projection of a cushion-like pad from its posterior surface. By these ingenious arrangements the adaptation of a single chamber to the very different functions of breathing and swallowing is effectually provided for.

JOINTS AND MUSCLES OF THE UPPER LIMB.

The upper limb is joined to the trunk at the *sterno-clavicular articulation*. This is a diarthrodial joint; the bones are retained together by investing ligaments; a meniscus is interposed between the articular surfaces, so that the joint possesses two synovial membranes. A strong ligament, which checks too great upward movement, connects the clavicle and first rib. The two bones of the shoulder girdle articulate with each other at the diarthrodial *acromio-clavicular joint*; but, in addition, a strong ligament, which checks too great displacement of the bones, passes between the clavicle and coracoid. The movements of the upper limb on the trunk take place at the sterno-clavicular joint, and consist in the elevation, depression, and forward and backward movement of the shoulder.

The *Shoulder Joint* is a ball-and-socket joint, the ball being the head of the humerus, the socket the glenoid fossa of the scapula. A large capsular ligament, which is pierced by the long tendon of the biceps muscle, and lined by a synovial membrane, incloses the articular ends of the two bones, and is so loose as to permit a range of movement greater than takes place in any other joint in the body. The free range of movement of the human shoulder is one of its most striking characters, so that the arm can be moved in every direction through space, and its efficiency as an instrument of prehension is thus greatly increased. The movement of abduction, or extension, which elevates the arm in line with the axis of the scapula, is characteristically human, and a distinct articular area is provided on the head of the humerus for this movement.

The *Elbow Joint* is the articulation between the humerus, radius, and ulna; the great sigmoid cavity of the ulna is adapted to the trochlea of the humerus, and the cup of the radius to the capitellum. The joint is inclosed by a capsular ligament lined by a synovial membrane, which is subdivided into anterior, posterior, internal, and external bands of fibers. Flexion and extension are the two movements of the joint, and the range of movement is limited by the locking at the end of flexion of the coronoid process into the coronoid fossa of the humerus, and at the end of extension of the olecranon process into the olecranon fossa. The elbow joint is a hinge with screwed surfaces; the path described by the hand and forearm is a spiral, so that during flexion they are thrown forward and inward.

The *Radio-ulnar Joints* are found between the two bones of the forearm. The head of the radius rolls in the lesser sigmoid cavity of the ulna, and is retained in position by a ring-like ligament which surrounds it; the shafts of the two bones are connected together by the interosseous membrane, their lower ends by a capsular ligament and a triangular fibro-cartilage or meniscus. The *Wrist or Radio-carpal Joint* is formed above by the lower end of the radius and the triangular meniscus, below by the upper articular surfaces of the scaphoid, semi-lunar, and cuneiform bones.

The *Carpal and Carpo-metacarpal Joints* are constructed thus:—The articular surfaces are retained in contact by certain ligaments passing between the dorsal surfaces of adjacent bones, by others between their palmar surfaces, and by interosseous ligaments between the semi-lunar and cuneiform, semi-lunar and scaphoid,

os magnum and unciform, os magnum and trapezoid; lateral ligaments also attach the scaphoid to the trapezium, and the cuneiform to the unciform.

The *Metacarpo-phalangeal* and *Inter-phalangeal Joints* are connected by lateral ligaments passing between the bones, and by an arrangement of fibers on their dorsal and palmar surfaces.

In studying the muscles which move the digits, it will be advisable, on account of the freedom and importance of the movements of the thumb, to examine its muscles independently. These muscles either pass from the forearm to the thumb, or are grouped together at the outer part of the palm, and form the elevation known as the ball of the thumb; they are inserted either into the metacarpal bone or the phalanges.

The four fingers can be either bent, or extended, or drawn asunder, *i. e.*, abducted; or drawn together, *i. e.*, adducted. The fingers are extended or straightened by muscles inserted into the back of the second and third phalanges; the extensor muscles descend from the back of the forearm,—one, the common extensor, subdivides into four tendons, one for each finger, but in addition the index and little fingers have each a separate extensor muscle, the tendon of which joins that of the common extensor. The index finger possesses more independent movement than the other digits—hence its more frequent use as a “pointer;” the extensor tendons of the little and ring fingers are usually united together, so that these digits are associated in their movements. The human hand is a perfect instrument of prehension; not only can the individual fingers be bent into hooks, but the thumb can be thrown across the front of the palm, so that it can be opposed to the several fingers, and objects can therefore be grasped between it and them; but further, this power of opposing the thumb permits objects to be held in the palm of the hand, which may be hollowed into a cup or made to grasp a sphere.

The innominate bones are connected to the spinal column by the sacro-iliac joints and the sacro-sciatic ligaments. The *Sacro-iliac Joint* is between the side of the sacrum and the internal surface of the ilium, the articular surfaces of which bones are covered by cartilage, and connected together by short, strong ligaments. The *Hip Joint* is a ball-and-socket joint; the ball is the head of the femur, and the socket the cup-shaped acetabulum in the haunch bone, the depth of the cup being increased by a ligament which is attached around the brim. A large capsular ligament, which is especially strong in front, incloses the articular surfaces. The ligament is lined by a synovial membrane, which also invests the neck of the thigh bone. Within the joint is the round or suspensory ligament attached to the head of the thigh bone and to the sides of the depression at the bottom of the acetabulum. While the hip joint possesses considerable mobility, it has much more stability than the shoulder, owing to the acetabulum being deeper than the glenoid fossa, and the greater strength and tension of the fibers of its capsular ligament. The muscles which move the thigh at the hip joint are situated either behind the joint, where they form the fleshy mass of the buttock, or at the front and inner side of the thigh. In standing erect the hip joints are fully extended, and the mechanical arrangements in and around these articulations are such as to enable them to be retained in the extended position with but a small expenditure of muscular power. As the weight of the body in the erect attitude falls behind the joints, the strong anterior fibers of their capsular ligaments are made tense, and the extended position of the joints is preserved. So long as the center of gravity falls within the basis of support of the body, *i. e.*, the space

between the two feet when standing on both legs, the body will not fall.

The *Knee* is the largest and most complicated joint in the body. It consists of the femur, tibia and patella. The patella moves up and down the trochlear surface of the femur, while the condyles of the femur roll upon the semilunar cartilages and articular surfaces of the tibia. A powerful investing ligament incloses the articular surfaces. This ligament is subdivided into bands, one on each side of the joint—the internal and external lateral ligaments—a posterior and an anterior. The anterior extends from the patella to the anterior tubercle of the tibia, and serves both as a ligament and as the tendon of insertion of the extensor muscles of the leg. The movements at this joint are those of flexion and extension. The flexors are the three great muscles on the back of the thigh, called the ham-strings; they all arise from the ischial tuberosity, and are inserted—the biceps into the head of the fibula, the semitendinosus and semi-membranosus into the upper end of the tibia. The extensors form the fleshy mass on the front and outer side of the thigh; one muscle, the rectus, arises from the ilium—the others, the vasti, from the shaft of the femur; and they are all inserted by a powerful tendon into the patella, and through the anterior ligament of the knee into the tibia. The patella is indeed a sesamoid bone, developed in the tendon of these muscles. The knee can be bent so that the calf can touch the back of the thigh, and in this position the patella is drawn down in front of the joint, as in kneeling.

The *Tibio-fibular Joints* are found between the upper and lower ends of the bones, and in addition a strong interosseous membrane fills up the interval between their shafts. The movement between the two bones is almost inappreciable.

The *Ankle Joint* is formed by the convex upper and the lateral surfaces of the astragalus fitting into the concavity formed by the lower end of the tibia and the two malleoli. An investing ligament, lined by the synovial membrane, incloses the joint; the lateral portions of this ligament form distinct bands, and are much stronger than the anterior and posterior fibers.

At the ankle joint movements of flexion and extension take place. The so-called extension of the foot is due to the action of the gastrocnemius and soleus, the great muscles of the calf of the leg, which are inserted by the Tendo Achillis into the posterior prominence of the os calcis or heel. This movement is made at every step in walking or running, and the great size of the calf-muscles is in relation to their use in the act of progression. The foot cannot, however, be drawn so far back as to be brought into direct line with the leg. In standing erect the foot is at right angles to the axis of the leg, the astragalus is locked in between the two malleoli, and the fibers of the lateral ligaments are tense, so as to check movement forward or backward, and prevent displacement. The individual toes are bent on the sole by the action of the flexor muscles inserted into the plantar surface of the phalanges, and they are straightened by the extensor muscles inserted into their dorsal surfaces; the toes can also be drawn asunder or abducted, and drawn together or adducted, chiefly by the action of the interossei muscles. The hallux or great toe is the most important digit; a line prolonged backward through it to the heel forms the proper axis of the foot, and the sole chiefly rests upon the pads of integument situated beneath its metatarsophalangeal joint and the heel. The act of walking consists in the movement forward of the trunk by the alternate advancement of the lower limbs. Suppose a person to be standing erect, with one leg a little

in advance of the other; the body being inclined slightly forward, is pushed in advance by the extension of the hindmost limb, so that the weight falls more and more upon the advanced leg, which at the same time is shortened by bending the knee and ankle. The heel of the hindmost limb being then raised by the action of the muscles of the calf, the toes press against the ground so as to push the trunk so far in front of the advanced limb as to be no longer safely supported by it; the hindmost is then raised from the ground by muscular action, and allowed to swing forward by its own weight, but guided by the muscles, until the toes touch the ground in front of the opposite limb. A step has now been made, and the limbs are in a corresponding but opposite position from that in which they were when the step commenced; a repetition of the act constitutes another step, and so the alternate action continues.

Before proceeding to the description of the other organic systems of which the human body is built up, it may be well to enter into the consideration of the minute or microscopic structure of its constituent parts. These parts may primarily be divided into fluids and solids. The fluids are the blood, the lymph, the chyle, the secretions of the various glands, and of the serous and synovial membranes. The solids form the framework of the several organic systems, and assume different appearances in different localities. Sometimes they are arranged in compact solid masses, as in cartilage; at others they are elongated into fine threads or fibers, as in muscle, tendon, nerve; at others they are expanded into thin membranes, as in the fasciæ or aponeuroses, the serous, synovial, and mucous membranes; at others they are hollowed out into distinct tubes for the conveyance of fluids, as in the blood-vessels, the lymph and chyle vessels, and the ducts or glands. To the solids of the body, whatever their form may be, the general name of Tissues or Textures is applied. Each organic system may be regarded as in the main composed of a tissue or texture peculiar to and characteristic of itself. Thus, the bones are essentially composed of the osseous tissue, the muscles of the muscular tissue, the nervous system of the nervous tissue, fibrous membranes of the fibrous or connective tissue, etc. But though the essential constituent of each organic system is a tissue peculiar to that system, yet in most localities certain other tissues are mingled with that which is to be regarded as the characteristic texture of the part. In a muscle, for example, not only is the muscular tissue present, but mingled with it are connective tissue, nerve tissue, blood vessels, and lymph vessels. A gland also not only consists of its proper tissue, the secreting cells, but of more or less connective tissue, nerves, blood and lymph vessels and gland ducts. Indeed, there are few localities in which, along with the proper tissue of the part, blood and lymph vessels, nerves and connective tissue, are not found; and to a part built up of two or more tissues the name of an Organ is applied. Thus the muscular system consists of the series of organs which we call the muscles, the glandular system of the several organs called glands, and so on. Each tissue and each organ, into the construction of which that tissue enters as the characteristic texture, possesses not only distinctive structural but also distinctive functional properties. Thus the muscular tissue is characterized by the property of contractility, and the muscles, of which it forms the essential texture, are organs of motion or locomotion; the osseous tissue is characterized by its hardness and strength, and the bones, of which it forms the essential texture, are organs of protection and support.

The blood is the well-known red fluid which circulates throughout the blood-vascular system. As its

composition and general properties will be described in the article PHYSIOLOGY, the solid particles only, which are suspended in the liquid sanguis, will be considered here. If a drop of human blood be examined under the microscope, crowds of minute bodies, the blood corpuscles, or blood globules, may be seen in it. These present two different appearances, and are distinguished by the names of red and white blood corpuscles.

The red corpuscles, which are by far the more numerous, are minute circular discs, slightly concave on both surfaces. Their average diameter is about $\frac{1}{2000}$ th of an inch, and their thickness about $\frac{1}{4}$ th of that measurement; hence they are not spheres, as the old name blood globules would imply. They are non-nucleated. Single corpuscles have a faint fawn-colored hue, but collectively they give to the blood its characteristic red color. This color is due to the presence in the corpuscles of the substance termed *hemoglobin*. It has been estimated by Vierordt and Welcker that 5,000,000 red corpuscles are present in every cubic millimetre of healthy human blood.

In all birds, reptiles, and amphibia the red corpuscles are oval or elliptical, and in each corpuscle an oval or elliptical nucleus is situated. In all fishes they are nucleated and also elliptical in form, except in some of the Cyclostomata, which possess circular discs.

The white or colorless corpuscles are comparatively few in number in the healthy human blood. Welcker has estimated the normal relative number as one white to 335 red; in pregnant and menstruating women the proportion is increased to about one to 280. In some forms of disease the proportion is so very materially increased that they appear to be almost as numerous as the red.

The red blood corpuscles in all vertebrata, except the mammalia, are nucleated clumps of protoplasm; they are therefore minute cells. What their precise homology may be is somewhat difficult to say, owing to the obscurity which prevails as to their exact origin.

The lymph is the fluid found in a subdivision of the vascular system named the lymph vascular system. It is transparent and colorless, and contains numerous corpuscles floating in it, which correspond, in appearance, structure, and the possession of the property to amoeboid movements, to the white corpuscles of the blood. The lymph corpuscles are formed in the glands situated in the course of the lymph vessels, and are carried away from the glands by the stream of lymph which flows through them.

The chyle is a milky fluid found during the period of digestion in the delicate lacteal vessels which pass from the walls of the intestine. The lacteals join the lymphatics at the back of the abdomen to form the thoracic duct in which the lymph and chyle become mingled together. The chyle contains corpuscles similar to the lymph corpuscles, which are apparently derived from the lymph glands in the mesentery, through which the chyle flows on its way to the thoracic duct. The fluid of the lymph, the chyle, and the blood, in which the corpuscles are suspended, is sometimes described as a fluid intercellular substance. Corpuscles possessing the type of structure of the lymph corpuscles are named lymphoid cells or *leucocytes*.

The free surfaces covered by an epithelium are the skin and the membranes, named, from the character of their secretion, mucous membranes. The Mucous Membranes line internal passages and canals, and are continuous at certain orifices with the skin. Mucous membranes also line the ducts of the various glands which open on the surface either of the skin or the several mucous membranes.

The epithelial cells, whether arranged in one or several

strata, rest upon a subjacent tissue, which, from its relation to the cells, may be called *sub-epithelial*. The sub-epithelial tissue is a delicate modification of the fibrous form of connective tissue, and in it the nerves and the blood and lymph vessels of the skin and mucous membranes ramify; hence it is sometimes described as a fibro-vascular tissue or *corium*.

The adipose or fatty tissue varies in its amount in different individuals. It is especially found in the marrow of the bones; as a layer beneath the skin, differing in thickness in different individuals; and collected in the cavity of the abdomen in the folds of peritoneum, known as the mesentery and omenta, in which, and indeed in the other localities where it occurs, it is intimately associated with the connective tissue. It consists of cells, which vary in size from $\frac{3}{100}$ th to $\frac{1}{100}$ th inch, usually ovoid or spherical in form, though when collected into masses they may be laterally compressed. These cells are sometimes isolated, though most usually arranged in rows or clusters to form lobules of fat. The number of cells in a given lobule varies with the size of the lobule. The distinctive contents of these cells in a minute drop of oil, which, when examined by transmitted light, presents a bright appearance; but when seen by reflected light, looks, as Monr *primus* described it long ago, like a cluster of pearls. Each fat cell possesses a distinct wall, as can be readily demonstrated by digesting these cells in ether, when the oil is dissolved out and the membranous wall remains. The nucleus of the fat cell is more difficult to demonstrate, and when seen is found attached to the inner surface of the cell wall. In the fat of old persons, and in specimens of this tissue which have been removed from the body for a length of time, a stellate group of acicular crystals is not infrequently to be seen in the interior of the cell, which consists either of margaric or margaric acid, one of the constituents of human fat. The lobules of fat cells are included between bundles of the areolar variety of connective tissue, which form their supporting framework. But, in addition, they are more or less perfectly surrounded by a network of capillary vessels, which not only serves to convey to them blood for their nutrition, but aids in retaining them in position.

In some parts of the body a yellow, brown, or black pigment is found in the interior of cells, which gives to the tissue and organ a characteristic color. In the colored races of mankind, and in certain parts of the body of the white races, pigment is produced in the cells of the cuticle or epidermis, more especially in the cells of the deeper strata or rete Malpighi. In the connective tissue corpuscles, also, more especially in the dermis of fish, amphibia, and reptiles, pigment is found in considerable abundance. The choroid coat of the eyeball owes its dark brown or black color to the presence of pigment in the interior of the cells.

By the term cartilage, or cartilaginous tissue, is meant a group of tissues which, though usually found in the form of plates or bars, yet differ in various aspects from each other, both in naked eye and microscopic characters. They agree, however, in forming solid textures, opaque when seen in mass, but, in thin slices, translucent, pearly, or bluish white, firm in consistence, but easily cut with a knife, endowed with considerable elasticity, and yielding chondrine on boiling. Cartilage is of greater importance in the fœtus, and in the immature condition of the body than in the adult, for in early life the bones are in a great measure formed of it. As development and growth proceed, a considerable proportion of the cartilage becomes converted into bone, and is called, therefore, *temporary* cartilage, while the remaining portion continues as cartilage throughout life and is termed permanent.

The osseous tissue, or bone, is that which constitutes the hard framework of the skeleton. Each bone consists of a hard, more or less dense, tough, and but slightly elastic material. The elasticity of the bones is more marked in young than in adult and aged persons. From differences in their external configuration, bones are divided into long or cylindrical, *e.g.*, femur; short, *e.g.*, carpal or tarsal bones; flat or plate-like, *e.g.*, scapula; irregular bones, *e.g.*, vertebræ. These variations in shape do not, however, involve differences either in composition or minute structure. Bone consists chemically of an earthy and an animal substance intimately blended together. The earthy matter forms about two-thirds of it, and consists chiefly of phosphate of lime, which, from its abundance in bone, is frequently called "bone earth." Carbonate of lime and a small proportion of soda and magnesia salts are also present. The hardness of bone is due to the presence of the earthy matter. The animal matter forms the remaining third, and yields gelatine on boiling; it imparts elasticity and toughness to the bone, and binds together the particles of earthy matter.

Bone presents two different structural characters to the naked eye. The outer part of a bone is its hardest part, and forms a dense external shell, technically called the *compact tissue*. The interior of a bone is much less firm, and is made up of thin delicate plates or bars, or trabecles, which intersect each other at various angles, and form a lattice-like arrangement, technically called the *spongy* or *cancellated tissue*. The plates and bars of the spongy tissue are continuous with the inner surface of the compact tissue. In the long bones the interior of the shaft is hollowed into a canal, named the *medullary canal*, the walls of which are formed by the compact tissue, and the cancellated tissue is found only at the articular ends of these bones; the thickness of the compact tissue in a long bone is always greater at the center of the shaft than at or near the articular ends.

A macerated and dried bone, such as one sees in museums and in articulated skeletons, is a bone which has been deprived of several soft tissues by the process of putrefaction, which tissues are of the utmost importance in the economy of the bone in the living animal. A living bone is a complex organ, and a macerated bone is only the skeleton of a living bone. It is essential, therefore, in studying the structure of bone, that the attention should not be limited to the appearance presented by the macerated bone, but that the arrangement and structure of its soft tissues should be considered. The soft tissues of a bone are the periosteum and its prolongations, the marrow, the minute masses of nucleated protoplasm which occupy the lacunæ of the bone, the blood and lymph vessels, and the nerves.

The *Periosteum* is a strong fibrous membrane which invests all the exterior of a bone, except where the incrusting cartilage is continuous with its articular end.

The *Marrow* occupies the medullary canal of a long bone and the spaces in the cancellated tissue of bones generally. It occurs in two forms, red and yellow marrow. Red marrow is found in the bones of the fœtus generally, and in the cancelli of the plate-like, short, and irregular bones at a more advanced period.

The blood-vessels of a bone are abundant. It receives its arteries partly from the small arteries which ramify in the periosteum, the fine branches of which enter the Haversian canals, and form within them an anastomosing network of capillaries; partly through a special artery which enters the nutrient canal in the bone, to be distributed chiefly to the marrow; partly through small arteries which enter openings in the compact tissue near the articular extremities. The veins of bones are also abundant.

It is clear, therefore, that a bone, hard and dense though its texture seems to be, is yet hollowed out by spaces, passages, and canals which, under the several names of medullary canal, cancellated spaces, nutrient canal, Haversian canals, Haversian spaces, lacunæ, and canaliculi, are occupied by blood-vessels or other soft tissues.

The muscular tissue is that which is actively concerned either in the movement of parts of the body on each other, or in the movement of the entire body from place to place; it is the active agent, therefore, both in motion and locomotion. It forms a large proportion of the general mass of the body, is the essential constituent of the muscles or flesh, and enters into the formation of the walls of the hollow viscera. It consists structurally of threads or fibers, some of which are distinguished by being marked with transverse stripes or striæ; others have no such markings. Hence it is customary to divide the fibers of the muscular tissue into transversely striped fibers and non-striped fibers. As a rule, the striped fibers are collected together to form those muscles which are under the influence of the will, so that both the muscles and the fibers of which they are composed are called voluntary. One important exception to this rule is, however, met with, for the muscular fibers of the heart, though transversely striped, are involuntary; the will exercises no control over the action of the heart. The non-striped fibers, and the muscles into the construction of which they enter, are in no instance, however, subject to the influence of the will; so that, without exception, they may be named involuntary.

The Nervous System consists of a number of organs which are named respectively Nerve Centers, Nerves, and Peripheral End-organs. The largest and most important Nerve Centers are the brain and spinal cord, which together constitute the cerebro-spinal nervous axis, and are lodged in the cranial cavity and spinal canal. But, in addition, numerous small bodies, usually oval in form, technically called ganglia, are situated in the axial part of the body, and form smaller nerve centers. The nerves are white cords which traverse the different regions of the body, both axial and appendicular, for a greater or less distance, for the purpose of connecting together the other sub-divisions of the nervous system. The Peripheral End-organs are minute structures connected with the peripheral extremities of the nerves. These end-organs are situated in the skin and other organs of sense, in the glands, blood-vessels, and muscles. The nerves establish communications and conduct nervous impulses, either between different nerve centers, or between nerve centers and peripheral end-organs, so as to associate together in their action parts of the nervous system often widely separated from each other. The nerve centers, nerves, and peripheral end-organs are arranged in two groups or systems—a Cerebro-spinal and a sympathetic. The Cerebro-spinal nervous system consists of the brain and spinal cord, the nerves which arise from or terminate in these large centers, the small ganglia connected with these nerves, and the end-organs at their peripheral terminations. The Sympathetic nervous system consists of the sympathetic ganglia, with their nerves and end-organs.

The several parts of the nervous system are not uniform in color, some being white, others gray. The nerves, at least those of the cerebro-spinal system, are invariably white, and white masses, variable in size, are met with in the brain and spinal cord; they constitute the white matter of the nervous system. In the nerve centers, both of the cerebro-spinal and sympathetic systems, gray matter is found, sometimes in considerable

quantities. This gray color is so characteristic that it may be regarded as marking the position of a nerve center.

The nervous system possesses a characteristic form of tissue—the nervous tissue—which in part consists of fibers (Nerve Fibers), and in part of cells (Nerve Cells). The nerve cells are found in the gray matter—that is, in the nerve centers—and sometimes also in the peripheral end-organs. The nerve fibers constitute the nerves, enter into the nerve centers, and pass into the peripheral end-organs; they form the white matter. But in addition to the characteristic nervous tissue, the nervous system also contains a considerable quantity of connective tissue, numerous blood-vessels, and some lymph vessels.

Nerve fibers are of two kinds: the white, medullated, or dark-bordered fibers, which are the characteristic fibers of the cerebro-spinal nervous system, though they do also sparingly occur in the sympathetic system; the pale, non-medullated, or gelatinous nerve fibers, which are the characteristic fibers of the sympathetic nervous system.

Nerve cells constitute an important division of the nervous tissue. They are the characteristic structures in the nerve centers, are susceptible to impressions, or nervous impulses, and are the texture in which the molecular changes occur that produce or disengage the special form of energy named nerve energy, the evolution of which is the distinctive mark of a nerve center. The central extremities of the nerve fibers lie in relation to, and are often directly continuous with, the nerve cells.

MEMBRANES OF BRAIN AND SPINAL CORD.—These nerve centers are invested by three membranes or meninges, which lie between them and the bones that form the walls of the cranial cavity and spinal canal. The membranes are named *dura mater*, *arachnoid mater*, and *pia mater*.

Dura mater.—The most external membrane, named *dura* from its firmness, consists of a cranial and a spinal subdivision. The cranial part is in contact with the inner table of the cranial bones, and is adherent along the lines of the sutures and to the margins of the foramina, which transmit the nerves, more especially to the foramen magnum. As the growth of the bone is more active in infancy and youth than in the adult, the adhesion between the *dura mater* and cranial bones is greater in earlier life than at maturity. From the inner surface of the *dura mater* strong bands pass into the cranial cavity, and form partitions between certain of the subdivisions of the brain.

Arachnoid mater.—The *arachnoid* is a membrane of great delicacy and transparency, which loosely envelopes both the brain and spinal cord. It is separated from these organs by the *pia mater*; but between it and the latter membrane is a distinct space, called *sub-arachnoid*. The sub-arachnoid space is more distinctly marked beneath the spinal than beneath the cerebral parts of the membrane, which forms a looser investment for the cord than for the brain. At the base of the brain, and opposite the fissures between the convolutions of the cerebrum, the interval between the *arachnoid* and the *pia mater* can, however, be seen, for the *arachnoid* does not, like the *pia mater*, clothe the sides of the fissures, but passes directly across between the summits of adjacent convolutions.

Pia mater.—This membrane closely invests the whole outer surface of the brain. It dips into the fissures between the convolutions, and a wide prolongation, named *velum interpositum*, lies in the interior of the cerebrum. The *pia mater* invests the spinal cord, and is more intimately attached to it than the brain, for

not only does it send prolongations into the anterior and posterior fissures of the cord, but slender bands pass repeatedly from its inner surface into the columns of the cord.

The MEDULLA SPINALIS, or SPINAL CORD, occupies the spinal canal, and extends from the foramen magnum to opposite the body of the first lumbar vertebra. In the early fœtus it equals in length the canal itself; but as the spinal column grows at a greater proportional rate than the cord, the latter, when growth has ceased, is several inches shorter than the column. The cord is continuous above with the medulla oblongata, while it tapers off below into a slender thread, the *filum terminale*, which lies in the axis of the sacral canal, and is attached below to the back of the coccyx, or to the fibrous membrane which closes in below the sacral canal. The length of the cord is from fifteen to eighteen inches. It approaches a cylinder in shape, but is flattened on its anterior and posterior surfaces, and presents two enlargements which have a greater girth than the rest of the cord.

The structure of the spinal cord shows it to be both a nerve center and a conductor of nervous impulses. The nerve cells in its gray matter give rise either directly, or through the delicate plexus formed by their branching processes, to nerve fibers, which may either pass out of the cord as the anterior and posterior roots of the spinal nerves, or may ascend to the brain as the columns of the cord. Hence the cord is anatomically continuous, on the one hand, through the nerves which arise from it, with the peripheral end-organs in the skin, and muscular system in which those nerves terminate; and, on the other hand, it is continuous with the brain. It serves, therefore, to conduct the impulses of touch-sensation from the skin upward to the brain, and the motor impulses from the brain downward to the muscles. But further, the cord is the great nerve center concerned in reflex excitomotor actions. It must, also, be remembered that the two halves of the cord are anatomically continuous with each other through the nerve fibers of the commissures, so that it acts as a single organ, and not as two organs. Experiments have shown that sensory impulses are conducted upward through the cord, not by that half from which the nerves arise that have been excited, but by the opposite half of the cord, which is obviously due to the crossing of the fibers of the posterior commissure. Motor impressions are, however, conducted downward by that half of the cord from which the nerves arise that pass to supply the muscles to be moved.

The spinal cord is well supplied with blood by numerous arteries, which terminate in a diffused capillary network. The capillaries are much more numerous in the gray matter of the cord than in the white columns. The spinal cord gives origin to thirty-one pairs of SPINAL nerves, which pass out of the spinal canal through the intervertebral foramina. These nerves are arranged in groups according to the region of the spine through the foramina in which they proceed.

By the term BRAIN or ENCEPHALON is meant all that part of the central nervous axis which is contained within the cavity of the skull. It is divided into several parts, named medulla oblongata, pons, cerebellum, and cerebrum. The medulla oblongata is directly continuous with the spinal cord through the foramen magnum. The cerebellum lies above, and immediately behind the medulla oblongata, with which it is directly continuous. The pons lies above and in front of the medulla, with which it is directly continuous. The cerebrum is the highest division, and lies above both pons and cerebellum, with both of which it is directly continuous.

The human brain is absolutely bigger and heavier

than the brain of any animal, except the elephant and the larger whales. It is also heavier relatively to the bulk and weight of the body than are the brains of the lower animals, except in some small birds and mammals. Considerable variations, however, exist in the size and weight of the human brain, not only in the different races of mankind, but in individuals of the same race and in the two sexes. The heaviest brains occur in the white races. The average weight of the adult European male brain is 49 to 50 oz., that of the adult female 44 to 45 oz., so that the brain of a man is on the average fully 10 per cent heavier than that of a woman. The greater weight of the brain in man as compared with woman is not in relation merely to his greater bulk, but is a fundamental sexual distinction; for, while there is a difference of 10 per cent in the brain weight, the average stature of women is, as Thurnam has calculated, only 8 per cent less than that of men. Dr. Boyd states that the average weight of the brain in the newly born male infant is 11.67 oz.; in the female only 10 oz. The exact age at which the brain reaches its maximum size has been variously placed at from the third to the eighth years by different authors; but it continues to increase in weight to 25 or 30, or even 40. After 60 the brain begins to diminish in weight; in aged males the average weight is about 45 oz., in females about 41 oz. In some cases the adult brain considerably exceeds the average weight. The brains of several men distinguished for their intellectual attainments have been weighed: the brain of Cuvier weighed 64½ oz.; of Dr. Abercrombie, 63 oz.; Professor Goodsir, 57½ oz.; of Spurzheim, 55 oz.; of Sir J. Y. Simpson, 54oz.; of Agassiz, 53.4 oz.; and of Dr. Chalmers, 53 oz. But high brain weights have also been found where there was no evidence of great intellectual capacity. Peacock weighed four male brains which ranged from 62.75 to 61 oz.; Boyd a specimen of 60.75 oz.; and Turner has recorded one of a boy aged fifteen which weighed 60 oz. In the brains of the insane high brain weights have also been observed. Bucknill met with a brain in a male epileptic which weighed 64½ oz.; Thurnam one which weighed 62 oz.; and in the West Riding Asylum out of 375 males examined, the weight of the brain in 30 cases was 55 oz. or upward, and the highest weights were 61 oz. in a case of senile dementia, 60½ oz. in a case of dementia, and 60 oz. in one of melancholia. No case has yet been recorded of the weight of the brain in a woman possessing intellectual eminence; but Boyd met with a woman's brain as high as 55.25 oz., and many instances of upward of 50 oz. in women where there was no evidence of high mental endowment. Skae, in a female monomaniac, observed a brain which weighed 61½ oz.; and of 300 females examined in the West Riding Asylum the weight of the brain in 26 cases was 50 oz. or upward, the highest weights being 56 and 55 oz. in two cases of mania. The size and weight of the brain do not therefore, *per se*, give an exact method of estimating the intellectual power of the individual, and a high brain weight and great intellectual capacity are not necessarily correlated with each other. It seems certain, if the human brain, even among the most uncultivated people, falls below 30 oz., that this low weight is not merely incompatible with intellectual power and activity, but is invariably associated with idiocy or imbecility; so that the human brain has a minimum weight below which intellectual action is impossible. Among the more cultivated races the minimum weight-limit of intelligence is, however, in all probability higher than 30 oz. It has been placed by Broca at 32 oz. for the female and 37 oz. for the male brain; and Thurman's numbers are about the same. To how low the brain in the microcephalous idiot may

fall is well shown in a case recorded by Theile, where it weighed only 10.6 oz., in Gore's case of 10 oz. 5 grs., and in Marshall's case $8\frac{1}{2}$ oz. But instances are not wanting in which the brains of idiots have exceeded even 50 oz. Langdon Down observed the brain of a male idiot aged 22, which weighed $59\frac{1}{2}$ oz.; and J. B. Tuke has recently met with a brain of 60 oz. in a male idiot aged 37, the capacity of whose cranium was $110\frac{1}{2}$ cubic inches. In the West Riding Asylum tables the brain weights in 10 idiots were not less than 34 oz. and in 5 cases exceeded 40 oz. As yet the opportunities of weighing the brain in the colored races have been but scanty. But from a very extensive series of observations made by Barnard Davis, not on the brains themselves, but on the cubic capacities of crania, from which an approximate estimate of the brain weight may be obtained with a fair measure of accuracy, the following facts are derived:—The average weight of the male brain in the African races is 45.6 oz.; of the female brain, 42.7 oz.; the average weight of the male brain in the Australian races is 42.8 oz.; of the female brain, 39.2 oz.; the average weight of the male brain in the Oceanic races, 46.5 oz.; of the female brain, 43 oz. The conclusions which may legitimately be drawn from an analysis of Barnard Davis's observations are as follows:—1st, That the average brain weight is considerably higher in the civilized European than in the savage races; 2d, That the range of variations is much greater in the former than in the latter; 3d, That there is an absence, almost complete, of specimens heavier than 54 oz. in the exotic races, so that the higher terms of the series are not represented; 4th, That though the male brains are heavier than the female, there is not the same amount of difference in the average brain weight between the two sexes in the uncultivated as in the cultivated people.

No reliable determinations have as yet been made of the exact proportion, as regards bulk and weight, which the convolutions bear to the corpora striata, optic thalami, and corpora quadrigemina, but data are obtainable of the relative weight of the pons, cerebellum, and medulla to the entire encephalon. Between the ages of 20 and 70 the ratio of weight of the pons, cerebellum, and medulla, to the entire brain, is as 13 to 100, and this relative weight is virtually the same in both sexes.

The Sympathetic Nervous System consists of a pair of gangliated cords, situated one on each side of the spinal column; of three great gangliated prevertebral plexuses situated in the thoracic and abdominal cavities; of numerous smaller ganglia lying more especially in relation with the thoracic and abdominal viscera; of multitudes of fine distributory nerves.

Each *Gangliated Cord* of the sympathetic extends along the side of the spine from the base of the skull to the coccyx. In the neck it lies in front of the transverse processes of the vertebrae; in the thorax, in front of the heads of the ribs; in the abdomen, on the sides of the vertebral bodies; and as it descends in front of the sacrum it approaches its fellow, so that in front of the coccyx the two are united in a single ganglion, the *ganglion impar*. Each cord consists of a number of ganglia united into a continuous cord by intermediate nerves. As a rule, the ganglia equal in number the vertebrae of the region. Thus, in the sacral region there are five ganglia, in the lumbar five, and in the thorax twelve; but in the neck there are only three, named superior, middle, and inferior; of these the superior is very large, and represents without doubt several smaller ganglia. From the superior cervical ganglion the cord is prolonged upward by an *ascending* or cranial offshoot through the carotid canal into the cranial cavity, and forms a plexus around the internal carotid artery, both in the carotid canal, named the *carotid*

plexus, and inner wall of the cavernous sinus, named the *cavernous plexus*. Through branches derived either directly or indirectly from these plexuses the sympathetic roots for the ciliary and spheno-palatine ganglia described in connection with the fifth nerve, are derived.

From the gangliated cord and its ascending or cranial prolongation a communicating and a distributory series of branches are derived. As the cerebro-spinal system is engaged in the supply of nerves to the voluntary muscles, the sympathetic is the medium of supply for the involuntary muscular apparatus, both in the coats of the vessels and in the walls of the hollow viscera. But though the vaso-motor nerves branch from the sympathetic ganglia, it must not be supposed that they have no connection with the cerebro-spinal system. The communicating branches between the sympathetic ganglia and the anterior divisions of the spinal nerves establish a connection between them and the cerebro-spinal nervous axis. By recent experiments, the tract of transmission of the vaso-motor fibers has been traced along with the anterior roots of the spinal nerves, through the lateral columns of the cord of the medulla oblongata, in which the vaso-motor nerve center lies a little to one side of the mesial plane, above the calamus scriptorius. In the distribution of the sympathetic to the glandular viscera, not only is it important to attend to their terminations in the muscular coat of the blood-vessels of the glands, but the termination of the nerves in connection with the secreting cells themselves must be taken into consideration. The communications between the cerebro-spinal and sympathetic systems, not only through the spinal nerves, but also through the pneumogastric, are to be kept in mind in connection with the effects produced by varying mental conditions on the secretions of the glands.

The organs of sense are the organs through the intermediation of which the mind becomes cognizant of the appearance and properties of the various objects in the external world. These organs are severally named nose, eye, ear, tongue and skin. For the excitation and perception of a sensation three sets of structures are necessary: *a*, a peripheral end-organ; *b*, a sensory nerve; *c*, a central organ. The peripheral end-organ is that part of the apparatus to which the stimulus necessary for the production of the sensation is applied. This stimulus causes nervous impulses to be propagated from the end-organ along the fibers of the sensory nerve to the central organ, in which that nerve terminates at its central extremity. These nervous impulses occasion molecular changes in the nerve cells of the brain, and the mind becomes conscious of a sensation. The shape and construction of each organ of sense is adapted to the application of the stimulus required for the production of the particular sensation to which the organ is subservient. Each organ of sense possesses its own characteristic form of end-organ. The touch corpuscles of the skin, the end-bulbs found in several mucous membranes, and the Pacinian corpuscles, are the end-organs occurring in their several localities; they have the peripheral ends of the sensory nerves terminating in their substance, and the axial cylinder of the nerve fiber ends in their interior. The rods and cones of the retina, the rods of Corti in the cochlea, the olfactory cells of the nose, and the gustatory bodies in the tongue, are the end-organs belonging to their several organs of sense; the sensory nerve fibers which terminate in relation with them have not yet, however, been traced into actual continuity with their substance. A stimulus, whatever may be its nature, applied to any organ of sense can excite only that kind of sensation for the production of which the organ is subservient. Thus a stimulus applied to the eye, whether it be the natural stimulus

of the waves of light, the mechanical stimulus of a blow, or an electric stimulus, can only excite the sensation of light. Stimuli applied to the ear can only excite the sensation of sound, and in like manner with the other senses. In studying the anatomy of the organs of sense the arrangement of numerous accessory structures, which assist either in conducting stimuli or in modifying their effects, the arrangement and structure of the peripheral end-organs, and the origin, course, and distribution of the sensory nerves, will have to be considered.

The **Nose** or organ of smell is a large cavity situated in the face, between the orbits, above the mouth, and below the cribriform plate of the ethmoid bone. It communicates by the *anterior nares*, or nostrils, with the external atmosphere, by the *posterior nares* with the pharynx, and through it with the larynx, trachea, and lungs. It is the proper entrance to the respiratory passage, is accessory to the production of the voice, aids in the sense of taste, and forms one of the most important features of the face. It is sub-divided into a right and a left chamber by a vertical mesial partition, the *septum nasi*, so that the nose is a double organ in the same sense as the eyes or ears are double. The walls of the cavity of the nose are formed partly of bone and partly of cartilage. The cartilages form the point, the alæ, and a part of the *septum nasi*. The *mesial* or *sepal cartilage* is triangular in shape, and fits into the interval between the vomer, the mesial plate of the ethmoid, and the nasal spine of the superior maxilla. Anteriorly and inferiorly its border is free, projects on to the face, and forms the *columna* of the nose. The *lateral cartilages* form the tip and alæ.

The *olfactory region* is the seat of distribution of the olfactory nerve and of its peripheral end-organs. It corresponds to the roof of the nose, to the superior and middle turbinata, and the upper two-thirds of the septum. The mucous membrane is thick, soft, easily destroyed, of a yellowish brown color, and blended with the periosteum. Between the epithelium cells the characteristic olfactory cells of Schultze are situated. Each *olfactory cell* consists of a globular or fusiform body, from which two long processes arise; one, the *peripheral process*, passes vertically between the adjacent cylindrical epithelium cells to the free surface of the mucous membrane; in amphibia, reptiles, and birds it projects beyond the plane of the epithelium as a simple hair-like structure, or subdivided into several slender "*olfactory hairs*"; in fish and mammals, man inclusive, it ends, without forming a hair-like prolongation, on the general plane of the mucous surface. The second or *central process* of the olfactory cell extends toward the sub-epithelial connective tissue; it is finer than the peripheral process, and has not infrequently a varicose appearance like a nerve fiber.

The **EYEBALL**, globe of the eye, or organ of vision, is a complex optical apparatus situated in the cavity of the orbit, imbedded to a large extent in loose fat, and with several muscles attached to it. Its form approximates to the spheroidal, but it actually consists of segments of two spheres, the posterior of which is the larger.

The eyeball consists of three coats or tunics, which inclose three translucent refracting media. The first external coat consists of a posterior, white, opaque part, the *sclerotic*, which corresponds in its area with the posterior larger segment of the ball, and of an anterior, translucent part, the *cornea*, which corresponds in its area with the anterior smaller segment of the eyeball. Piercing the sclerotic coat is the optic nerve, which enters the globe about one-eighth inch to the nasal or inner side of its antero-posterior axis. The second

or middle coat, or *tunica vasculosa*, consists of a posterior part or *choroid*, the area of which corresponds almost exactly with the sclerotic; this coat possesses anteriorly numerous folds, the *ciliary processes*, which are continuous with the *iris*, a structure which lies behind the cornea. The third or internal or nervous coat is named the *retina*, and in it the optic nerve terminates. The inclosed refracting media occupy the axis of the globe, and are named from before backward the *aqueous humor*, *crystalline lens*, and *vitreous body*.

The retina is supplied with blood by the *arteria centralis*, which, traversing the axis of the optic nerve, reaches the retina at the optic disc. In the retina it branches dichotomously in the nerve fiber layer, avoiding, however, the yellow spot, and its terminal twigs reach the ora serrata. The capillaries form in the more anterior layers of the retina a distinct network, which does not enter the external granule and bacillary layers, but penetrates the yellow spot, though not the fovea centralis. The blood is conveyed from the retina by the central vein which accompanies the artery in the optic nerve, and opens either into the ophthalmic vein or directly into the cavernous sinus. The veins and capillaries of the retina have been described by His as completely invested by perivascular lymphatic sheaths, while the arteries only possess such sheaths for a limited part of their course.

The *Optic Nerve* itself passes from the orbit through the optic foramen into the cranial cavity, where it arises from the *optic commissure*. This commissure is a flattened band formed by the junction of the two *optic tracts*. Each tract winds backward around the tuber cinereum and crus cerebri to arise from the optic thalamus, corpora quadrigemina, and geniculata; and some observers also state that it derives fibers from the tuber cinereum and lamina cinerea. In the commissure an interchange takes place between the fibers of opposite nerves and tracts, so that not only does an optic nerve contain fibers derived from the tract on its own side, but from the opposite tract, and it has even been stated that fibers pass across the commissure from one optic nerve to the other, and from one optic tract to the other.

The *Aqueous Humor* is a limpid watery fluid, containing a little common salt in solution, which occupies the space between the cornea and the front of the crystalline lens. In this space the iris lies, and imperfectly divides it into two chambers, an anterior and a posterior, which communicate with each other through the pupil. The anterior chamber, of some size, is situated between the iris and cornea; but as the iris is in contact with the front of the lens, the posterior chamber is reduced to a mere chink between the circumference of the iris and that of the lens.

The *Crystalline Lens* is situated behind the iris and pupil, and in front of the vitreous body. It is a transparent bi-convex lens, with its antero-posterior diameter one-third less than the transverse, its posterior surface more convex than the anterior, and with its circumference rounded. It consists of a capsule and the body of the lens inclosed by the capsule. The *lens capsule* is a transparent, smooth, structureless, and very elastic membrane, about twice as thick on the anterior as on the posterior surface of the lens. It is non-vascular in the adult, though in the fetus a branch of the central artery of the retina which traverses the vitreous humor ramifies in its posterior portion. A single layer of polygonal cells lies between the body of the lens and the anterior portion of the capsule. The *lens body* is softer at its periphery than in its center. It is built up of concentric layers, and on both the anterior

and posterior surfaces lines are to be seen radiating from the central pole of each surface toward the circumference of the body. The radiated pattern varies in different animals. In the human foetus there are usually three lines, but in the adult they are more numerous. The *Vitreous Body* is much the largest of the refracting media, and occupies the largest part of the space inclosed by the tunics. Anteriorly it is hollowed out to receive the posterior convexity of the lens, but posteriorly it is convex and the retina is molded on it. It is as translucent as glass, jelly-like in consistency, and when punctured a watery fluid drains out. The Eyeball is an optical instrument, constructed on the plan of the camera obscura. The cornea, aqueous humor, lens, and vitreous body are the translucent media which, like the glass lens of the camera obscura, bring the rays of light to a focus. The retina is the sensitive plate on which the optical picture is thrown. In considering the relation of the retina to the visual rays, it must be kept in mind that the place of entrance of the optic nerve is insensible to light, and that the most sensitive part of the retina is the yellow spot, with its fovea centralis, where the optic nerve fibers are absent, but where the bacillary layer reaches its maximum size. It is clear, therefore, that the rods and cones of this layer, and not the optic nerve fibers, are the structures in the retina which are stimulated by the light; and it is probable, as was suggested many years ago by Goodsir, that these rods and cones are impressed by the light, not as it enters the eye directly, but as it is reflected backward from the choroid along their axes. The iris is the diaphragm which, by opening or closing the pupil, admits or cuts off the rays of light. The ciliary muscle represents the adjusting screw of the camera; through its attachment to the ciliary processes and their relation to the suspensory ligament of the lens, it is able to act upon the lens and modify the curvature of its anterior surface; for when the eye is to be accommodated to the vision of near objects the anterior surface of the lens becomes more convex than when distant objects are being examined. In relation to the eyeball several accessory parts are found.

The *Eye-Brows* are projections of the integument, from which short, stiff hairs grow.

The *Eye-Lids*, or *palpebrae*, are two movable curtains, an upper and a lower, which protect the front of the globe. Between each pair of lids is a horizontal fissure, the *palpebral fissure*. From the free margins of the two lids project short hairs, the *eye-lashes* or *cilia*; the upper set curve downward and forward, the lower set upward and forward; they also protect the front of the globe. Each eye-lid consists of skin; of the fibers of the orbicular sphincter muscle; of a thin plate of fibro-cartilage, the *tarsal cartilage*, to the inner end of which a fibrous band, the *tendo palpebrarum*, is attached, this tendon springing from the ascending process of the superior maxilla; and of the conjunctiva. Between the conjunctiva and the tarsal cartilage is a layer of glands, the *Meibomian glands*; each gland consists of a short duct, which expands at its sides into small sacculi. The sacculi contain short columnar cells; these secrete a sebaceous material, which escapes through the orifice of the duct at the border of the eye-lid.

The *Conjunctiva* is a mucous membrane, which forms the posterior layer of the eye-lid, and is reflected on to the anterior part of the sclerotic.

The *Lachrymal Apparatus* is engaged in the secretion of the tears, and in conveying them away from the front of the globe. The *lachrymal gland* occupies a depression in the outer part of the roof of the orbit. It is smaller than an almond, is sub-divided into lobules,

and belongs to the group of compound racemose glands. It consists of the ramifications of short ducts, which terminate in small sacculi. The wall of each sacculus consists of a delicate *membrana propria*, and the cavity contains the polyhedral secreting cells. Outside the *membrana propria* is a capillary network derived from the lachrymal artery, but Giannuzzi and Boll have recently described a space between this network and the *membrana propria* which they believe to be continuous with the lymphatic system. Pflüger has described nerves as terminating in connection with the secreting cells. The excretory ducts of the gland are from six to eight, and open on the back of the upper eye-lid. The tears are washed over the surface of the globe by the involuntary winking of this lid. When the secretion is increased in quantity, in the act of crying, the tears flow over the cheek, but in ordinary circumstances they are conveyed away by two slender tubes, the *lachrymal canals*, which open by minute orifices, the *puncta lachrymalia*, one at the inner end of the free border of each eye-lid. These tubes open at their opposite ends into a small reservoir, the *lachrymal sac*, situated in a hollow in the lachrymal bone. From this sac a duct, the *nasal or lachrymal duct*, proceeds which opens into the inferior meatus of the nose, and here the tears mingle with the mucous secretion of that cavity.

The *EAR*, or organ of hearing, is a complex acoustic apparatus, situated in connection with the temporal bone. It is divided into three parts, named external, middle, and internal ear.

The *External Ear* consists of the pinna or auricle and the external auditory meatus. The *auricle* is the oblong convoluted body situated at the side of the head. Its incurved outer border is named the *helix*. Within this lies a curved ridge, the *anti-helix*, in front of which is a deep hollow, the *concha*, which leads into the external meatus. The concha is bounded in front by a prominence, the *tragus*, and behind by a smaller prominence, the *anti-tragus*; below the anti-tragus is the *lobule*, which forms the most depending part of the auricle. The framework of the auricle is formed of yellow elastic fibro-cartilage invested by integument, except the lobule, which consists merely of a fold of integument containing fat. Attached to the cartilage are not only the three auricular muscles, but also certain smaller muscles called the proper muscles of the pinna. Thus the *greater muscle of the helix* is placed on its anterior border; the *lesser muscle of the helix* is situated where it arises out of the concha; the *muscle of the tragus* lies on the front of that prominence; the *muscle of the anti-tragus* is placed on the back of that prominence; the *transverse muscle* on the posterior or cranial surface of the auricle.

The *External Meatus* leads from the bottom of the concha into the temporal bone, and is separated from the tympanum or middle ear by the *membrana tympani*. It is a crooked passage one and a quarter inch long, inclined at first forward and upward, then downward and inward. The wall of the outer end of the passage is formed of fibro-cartilage continuous with the cartilage of the auricle, while that of the deeper end is formed of the plate-like tympanic part of the temporal bone. The passage is lined with integument continuous with the skin of the auricle, in which are situated numerous hairs, together with ceruminous glands which secrete the well-known yellow "wax."

The *Tympanum*, or *Drum*, or *Middle Ear*, is a chamber irregularly cuboidal in form, situated in the temporal bone between the bottom of the meatus and the internal ear. The outer wall is formed of the *membrana tympani*, which inclines obliquely downward and inward at the bottom of the external meatus, at an

angle of 55° to the axis of the meatus, while the membranes in the two ears form with each other an obtuse angle of 130° to 135° . The tympanic membrane is attached to a groove at the bottom of the meatus, and is concave on its outer, convex on its inner surface. It consists of three layers: an external tegumentary, continuous with the skin of the meatus, which contains no hairs or glands; an internal mucous, continuous with the mucous lining of the tympanum; and an intermediate membrana propria, which consists of unyielding fibers arranged both radially and circularly. The radial fibers radiate from the point of attachment of the handle of the malleus. The membrana propria is usually said to be destitute both of the nerves and vessels, but Kessel states that nerves, blood, and lymph vessels exist in it as well as in the mucous and tegumentary layers. Immediately in front of the membrana tympani is the Glaserian fissure. The inner wall separates the tympanum from the labyrinth, and presents the following appearances: a rounded elevation or *promontory* caused by the first turn of the cochlea, on the surface of which promontory are grooves for the lodgment of the tympanic plexus of nerves; above the promontory is an oval opening closed in by a membrane, the *fenestra ovalis*, which corresponds with the vestibule; behind and below the promontory is a round opening closed in by a membrane, the *fenestra rotunda*, which corresponds with the tympanic passage in the cochlea. The floor of the tympanum is a narrow chink between the inner and outer walls; and the roof is formed by the anterior surface of the petrous-temporal bone. At its anterior wall the tympanum opens into the *Eustachian tube*, a canal which communicates with the nasal compartment of the pharynx immediately behind the inferior turbinal. The wall of the tympanic end of this tube is formed of bone, that of the pharyngeal end of a curved plate of hyaline cartilage, which is connected to the bone by fibro-cartilage; its pharyngeal orifice is dilated into a trumpet-shaped mouth; through this tube the ciliated mucous membrane of the nasal part of the pharynx is prolonged into the tympanum. The cartilaginous wall of the tube does not completely surround it, but is completed by a fibrous membrane, and a layer of voluntary muscle, named by Rüdinger the dilator tube. Above the tympanic orifice of the Eustachian tube is a fine canal, through which the tensor tympani muscle enters the tympanum. At its posterior wall the tympanum communicates with the air sinuses in the mastoid temporal; here also is found a small hollow eminence, the *pyramid*, through a hole at the apex of which the tendon of the stapedius muscle passes; and a foramen which transmits the chorda tympani nerve.

The tympanic cavity contains three small bones, named malleus, incus, and stapes, arranged so as to form an irregular chain, stretching across the cavity from the outer to the inner wall.

The *Malleus* or hammer is the most external bone. It may be recognized a head separated by a constricted neck from an elongated handle. Close to the junction of the neck and handle a long slender process projects downward and forward to be inserted into the Glaserian fissure, and near the root of the long process a short process projects outward. By its handle the malleus is intimately connected with the center of the membrana tympani; by its head it articulates with the incus; while ligamentous fibers pass from it upward, forward, outward, and backward to the tympanic walls.

The *Incus*, or anvil-shaped bone, possesses a body and two processes; on the anterior surface of the body is a saddle-shaped hollow in which the head of the malleus fits; the short process projects almost horizontally backward, and is attached by a ligament to the poste-

rior wall of the tympanum; the long process extends at first downward and then inward, to end in a rounded projection, named *os orbiculare*, through which it articulates with the stapes.

The *Stapes*, or stirrup-shaped bone, possesses a head and neck, a base and two crura; the head articulates with the *os orbiculare* of the incus; from the constricted neck the two crura curve inward to the base, which is attached to the fenestra ovalis. The joint between the malleus and incus is diarthrodial and saddle-shaped, and the articular surfaces are inclosed by a capsular ligament. The joint between the incus and stapes is also diarthrodial, and possesses an investing capsular ligament. Toynbee and Rüdinger have described the base of the stapes and the margin of the fenestra ovalis as each invested by hyaline cartilage. Between these plates elastic fibers extend in a plexiform manner, and the intervals between them are occupied by fluid; the joint seems, therefore, a modified amphiarthrosis. The bones are moved on each other at these joints by small muscles. The *tensor tympani* arises from the apex of the petrous temporal, and the cartilage of the Eustachian tube enters the tympanum at its anterior wall, and is inserted into the malleus near the root. The *laxator tympani* muscle arises from the spine of the sphenoid, and the cartilage of the Eustachian tube enters the tympanum through the Glaserian fissure, and is inserted into the neck of the malleus. The *stapedius* arises within the pyramid, enters the tympanum through the hole at its apex, and is inserted into the neck of the stapes. The tympanum is lined by a mucous membrane continuous with that of the Eustachian tube, which invests the tympanic ossicles, ligaments, and muscles, and is prolonged backward so as to line the mastoid air sinuses. The epithelium covering this membrane, where it lines the floor and the adjacent part of the anterior, posterior, and internal walls, consists of ciliated columnar cells; but the epithelium covering the roof, the promontory, the membrana tympani, and the tympanic ossicles, is tessellated. In the sub-epithelial connective tissue the blood and lymph vessels and nerves of the tympanum ramify. Kessel has recently described in it certain *peculiar bodies*, which consist of a central axial band with a series of capsules, possessing a fibrillar structure, arranged concentrically around the axis; the function of these bodies is not known.

The formation of the auricle and external meatus is well adapted for collecting and transmitting sound vibrations inward to the middle ear and labyrinth. These vibrations strike the membrana tympani, and are propagated by the chain of bones across the tympanic cavity to the labyrinth. The pressure of the vibrations on the tympanic membrane forces that membrane inward, so that its inner surface presses on the handle of the malleus, the effect of which is to rotate the hammer about its axis; but by the ligamentous attachment of the malleus to the tympanic walls and to the incus, and, as Helmholtz has shown, by the interlocking of cog-like processes connected with the articular surfaces of the two bones, the range of movement is so limited that the pressure on the malleus is transmitted through the incus upon the stapes, which presses, therefore, on the membrane of the fenestra ovalis, so that the movements of the membrana tympani are thus transmitted to fluid within the labyrinth. The tensor tympani muscle tightens the tympanic membrane by drawing the handle of the malleus inward, and still further adapts the structures for the transmission of sound-vibrations. An antagonistic muscle, the laxator tympani, has also been described. There is some difficulty in determining the action of the stapedius, but if, as is probable, it draws the stapes from the fenestra ovalis, it will dimin-

ish the pressure of the chain of bones on that membrane.

The *Internal Ear*, named the *Labyrinth*, from its complex construction, is the part of the auditory apparatus in which the nerve of hearing is distributed, and where the peripheral end-organs are situated. It is imbedded in the petrous bone, and is divided into three parts, viz., vestibule, semicircular canals, and cochlea, each of which consists of an osseous and a membranous portion.

The *Vestibule* lies immediately internal to the tympanum, between it and the bottom of the internal auditory meatus; behind it are the semicircular canals, and in front is situated the cochlea. It is the part of the labyrinth which first appears in animals, and is therefore the most constant part of the organ. In the myxinoïd fishes a single semicircular canal is superadded to the vestibule, in the lamprey two canals, but in other fishes and in the higher vertebrates three canals exist. In amphibia, reptiles, and birds the cochlea is small and rudimentary in comparison with its development in mammals. The osseous vestibule is an ovoid chamber about one-eighth inch in diameter. In its outer or tympanic wall is the *fenestra ovalis*; in its inner are small *auditory foramina*, which transmit from the internal meatus the vestibular branches of the auditory nerve; behind these holes is the opening of a minute canal, the *aqueductus vestibuli*; its anterior wall communicates with the *scala vestibuli* of the cochlea, and into its posterior wall open the five orifices of the three semicircular canals.

The *Semicircular Canals* are named superior, posterior, and external. The superior and posterior are sometimes called the vertical canals, and the external the horizontal canal, but, as Crum Brown has shown, the superior and posterior lie in planes equally inclined to the mesial plane of the head, and the external is in a plane at right angles to the mesial plane. Further, the canals in the two ears have definite relations to each other; for while the superior canal of each ear is nearly parallel to the posterior canal of the other, the external canals in both ears lie nearly in the same plane. The canals are bent, forming nearly two-thirds of a circle, and would have had six openings into the vestibule had not the contiguous ends of the superior and posterior blended together to open by a common orifice. The opposite end of each of these canals and the outer end of the external canal dilate close to the vestibule to twice their usual diameter, and form an *ampulla*. The osseous vestibule and semicircular canals are lined by a periosteum invested by a tessellated endothelium, and contain a little fluid, the *perilymph*. In this fluid the membranous labyrinth is suspended.

The membranous vestibule is formed of two small sac-like dilatations, the walls of which are directly continuous with each other, though the cavities are separated by an intermediate partition. The upper and posterior dilatation, named *utricle*, is larger than the lower and anterior, named *sacculus*. The sacculus is continuous with the *ductus cochlearis* of the membranous cochlea, and both sacculus and utricle communicate by slender tubes with a short diverticulum lodged in the *aqueductus vestibuli*, to which the name of *ductus vestibuli* may be given. The membranous semicircular canals are about one-third the diameter of the osseous. Their walls are continuous with that of the utricle, and they open by five orifices into it. Each has an ampulla within the ampulla of the osseous canal. Both the sacculus and utricle are in places attached to the periosteal linings of the osseous vestibule, and delicate ligamentous bands connect the membranous semicircular canals to the periosteal lining of the tubes in which they are contained. The wall of the

membranous vestibule and canals consists of a delicate fibrous membrane lined by a tessellated endothelium. The inner part of this membrane has a vitreous or hyaline luster, and gives origin in the canals to short papillæ which project into the lumen. The membranous vestibule and canals are distended with the fluid *endolymph*. The sacculus, utricle, and ampullæ are specially modified in connection with the peripheral termination of the vestibular branches of the auditory nerve. The membranous wall forms in each of these dilatations a projecting ridge, the *crista acoustica*, to which calcareous particles, the *otoliths*, which may be either amorphous or crystalline, are adherent. The endothelial investment of the crista is elongated into columnar cells, and intercalated between them are fusiform cells, the *auditory cells*, each of which, as Schultze and other observers have described, possesses a peripheral and a central process. The peripheral process projects beyond the plane of the free surface of the endothelium into the endolymph as the *auditory hair*, while the central process extends into the sub-endothelial tissue, where the nerve plexus belonging to the terminal branches of the auditory nerve ramifies, and with which it is probably continuous. These auditory cells are, therefore, the peripheral end-organs of the vestibular branches of the auditory nerve, and their general arrangement is not unlike that of the olfactory cells of the nose.

The *Cochlea* is by far the most complex part of the labyrinth. It is about one-fourth of an inch long, and shaped like the shell of a common snail; its base lies near the internal meatus, and its apex is directly outwards. The osseous cochlea is a tube wound spirally two and a half times round a central pillar or *modiolus*. Both the pillar and the tube diminish rapidly in diameter from the base to the apex of the cochlea. The tube is imperfectly divided into two passages by a plate of bone, the *osseous spiral lamina*, which, springing from the modiolus, winds spirally around it, and projects into the tube.

The *TONGUE*, situated on the floor of the cavity of the mouth, is the chief organ provided for the excitation of the special sense of taste, but the under surface of the soft palate participates to some extent in this property. The tongue is also highly endowed with the sense of touch. The structures concerned in the excitation of taste and touch are situated in the mucous membrane which envelops the tongue. The tongue is also a muscular organ, and plays an important part in articulation, mastication, and deglutition. Its shape is flattened from above downward, so that it presents an upper surface or dorsum and a lower surface. Its posterior part is broad, forms the base or root of the organ, and is attached to the hyoid bone. Its anterior extremity or tip is more or less pointed, and its lateral margins or sides are rounded.

The muscles connected with the tongue are arranged in pairs, and form three distinct groups, viz., accessory, extrinsic, and intrinsic muscles.

The mucous membrane of the tongue forms a part of the general mucous lining of the mouth; it covers the dorsum, tip, sides, and under surface; is reflected from the under surface to the floor of the mouth, where it forms the *frænum* or bridle of the tongue, and is reflected also from the base to the epiglottis as the *fræna* of the epiglottis, as well as over the tonsils and anterior palatine pillars. This membrane has its free surface elevated into multitudes of fine processes, called the papillæ of the tongue, some of which are simple, others compound. The tongue is provided with several nerves. The hypo-glossal nerve supplies its muscular structure, but the inferior lingualis apparently receives a branch

from the chorda tympani of the facial. The lingual branch of the fifth is distributed to the mucous membrane of the anterior two-thirds of the tongue; it breaks up into minute branches, which enter the fungiform and filiform papillæ, but their exact mode of termination has not been precisely ascertained, though end-bulbs and gustatory bodies are said to have been seen in connection with some of the terminal branches. In connection with its terminal branches peculiar flask-shaped organs, called *gustatory bulbs* or *bodies*, have recently been described by Lovén, Schwabbe, and Engelmann, in the sides of the circumvallate papillæ.

The *SKIN*, or *Integument*, invests the entire outer surface of the body, and contains structures by the excitation of which the properties of things are determined by the sense of touch. The skin also contains accessory structures, as the nails, hairs, sebaceous glands, and sweat glands. The skin consists of a non-vascular cuticle or epidermis, and of a vascular and sensitive corium, or cutis vera.

The *Cuticle*, *Epidermis*, or *scarf skin*, forms the outer covering of the skin, and protects the cutis. It is a laminated structure, and consists of numerous layers of cells superimposed on each other. As these cells cover a free surface exposed to the air, they belong to the epithelium group. The thickness of the cuticle varies in different localities from $\frac{1}{16}$ th to $\frac{1}{8}$ th inch; where the skin is frequently exposed to pressure, as in the soles of the feet, the cuticle is the thickest and hardest; and the hands of those accustomed to manual labor have a hard and horny cuticle. The increase in thickness in these localities is for the purpose of protecting the highly sensitive cutis from injury. The outer surface of the cuticle in many parts of the body, especially the palm of the hand and the fingers, is marked by ridges and furrows; the ridges indicate the position and arrangement of the papillæ of the cutis, while the furrows are due to the sinking of the cuticle into the spaces between the rows of papillæ. The mouths of the sweat glands open on the surface of these ridges. The cuticle is divided into two strata.

When the cuticle is removed the surface of the cutis is seen to be studded with multitudes of minute elevations, the papillæ of the skin. These papillæ are either simple conical structures, or compound with two or three branches. They are largest in the palm and sole, being from $\frac{1}{16}$ th to $\frac{1}{8}$ th of an inch high, and are arranged in ridges, but more usually they are much shorter and irregularly distributed. The cutis is formed of connective tissue, in which stellate connective tissue corpuscles and elastic fibers are abundant. The deeper surface of the connective tissue of the cutis is reticulated, and is continuous with the bundles of connective tissue that form the areolar subcutaneous tissue. In the papillæ themselves the fibers of the connective tissue are not so well marked, and the surface of the papillæ possesses more of a homogeneous aspect, which gives rise to the appearance described as a basement membrane.

On the back of the last phalanx of each thumb, finger, and toe is situated a firm horny curved plate, the nail. Each nail rests on a bed, the surface of which is formed of the cutis, which also overlaps the side and root of the nail; thus the nail fits into a groove formed of the cutis something after the manner in which a watch-glass fits into its rim. A nail is merely a special modification of the cuticle, the cells of the superficial stratum of which are more horny, harder and more firmly adherent to each other than in the cuticle proper. Deeper than the horny stratum is the rete Malpighii of the nail, the cells of which are soft, as in the cuticle itself. The cutis forming the bed of the nail is studded

with papillæ, which are arranged in almost parallel rows, and are highly vascular. Nails grow both in length and thickness; the increase in thickness is due to the formation of nerve cells on the bed of the nail; the increase in length takes place through the formation of nail cells at its root, and as the nail is thus slowly pushed forward it requires to be cut at intervals. At the root, sides, and below the free border of the nail the cuticle is continuous with the substance of the nail itself.

Projecting from the surface of the skin are multitudes of elongated cylindrical horny structures, the hairs. In the skin of the scalp, the armpits, and the pubis, they are long and numerous; but in the eyebrows, eye-lashes, vibrissæ of the nostrils, and surface of the body generally, they are short. They are stronger and thicker in the skin of man than of woman, more especially on the cheeks, lips, and chin. Hairs do not grow from the skin of the palms and soles, the back of the ungual phalanges, and the surface of the upper eye-lids. Each hair is partially embedded in a depression of the skin, called a *hair follicle*. The deeper end of the follicle is somewhat dilated, and has in it a papilla, the *hair papilla*. The wall of the hair follicle is formed of the constituent structures of the skin; the outer part of the wall belongs to the cutis, and has been described as arranged in three layers, the external, middle and inner layer of the hair follicle. The external and middle layers are formed of connective tissue, with blood-vessels; while the inner, sometimes called the *vitreous layer*, is transparent and homogeneous, and continues with the so-called basement membrane of the cutis. The inner part of the wall of the hair follicle, or the *root-sheath*, belongs to the cuticle, and consists of two layers, the outer and inner root-sheaths. The *outer root-sheath* is continuous with the rete Malpighii, and consists of cells similar to those of that stratum. The *inner root-sheath* is continuous with the horny stratum of the cuticle, and consists of elongated scale-like translucent cells in which no nuclei can be seen.

A hair possesses a root, a shaft, and a tip; the root is embedded in the hair follicle, while the shaft and tip form the free projecting part of the hair. In the human hair the substance of the hair is composed of a *fibrous*-looking horny material, which by the action of strong sulphuric acid is resolved into elongated, closely compacted, fusiform cells, which in colored hairs contain pigment granules. In the thicker hairs the cells in the axis of the hair are polygonal, contain air and form a central pith or *medulla*. The hair is invested by imbricated scale-like cells, which form the *hair cuticle*. In different animals the size and relative proportion of the cells of the cuticle, medulla, and fibrous part of the hair present many modifications. The wool of the sheep has its cuticle scales, with well-defined serrated margins, so that the hair of this animal is well adapted for felting into cloth; in the bat, also, the cuticle cells are large and strongly serrated. The bristles of the pig, again, have the fibrous part of the hair largely developed. In the deer tribe the hair consists of polygonal medulla-like cells, which contain air. The root of the hair dilates at its deeper end into a bulb which embraces the hair papilla. It is softer in texture than the shaft, so that the cellular structure of the hair is more easily demonstrated. Next the papilla the cells are like those of the rete Malpighii, but when traced onward to the shaft they are seen to become differentiated, both in structure and composition, into the proper hair cells. The root is enveloped in a special sheath, termed the *sheath of Huxley*, composed of nucleated cells, which sheath, in the more superficial part of the follicle, blends with the internal root-sheath.

The hair papilla bears to the hair the same relation as a papilla of the cutis has to its investing cuticle, so that a hair is to be regarded as a specially modified cuticular structure. The human hair papilla is vascular, but no nerves have been traced into it. In the tactile hairs of the mammalia, however, nerves have been traced into their papilla.

The bristles, feathers, claws, hoofs, the horny envelope of the horn cores in the hollow-horned ruminants, and various tegumentary spines and scales, present in many animals, are, like hairs and nails, special modifications of the tegumentary system.

Each hair follicle has opening into it the excretory duct of a small gland, named a *sebaceous gland*. This gland consists of the excretory duct, and of from two to twenty grape-like saccular expansions which open into the duct. The wall of the sacculi and of the duct is continuous with the vitreous layer of the outer wall of the hair follicle. Capillary blood-vessels are distributed on the outer wall of the sacculi. The sacculi are almost entirely filled with polygonal cells containing drops of fat, which cells are continuous with the epithelial lining of the gland duct and the cells of the outer root-sheath. These glands secrete a fatty material, which lubricates the surface of the hair. Sometimes a small parasite, called *Acarus folliculorum*, is found in a sebaceous gland.

Hairs are developed about the fourth month of embryo life, within depressions in the cutis, which form the future hair follicles, filled with cells similar to, and contiguous with, those of the rete Malpighii. When a hair is pulled out of its follicle the cells of the root-sheath are drawn out along with it. A new hair will be developed at the bottom of a follicle from which the hair has been shed as long as cells continue to be formed around the papilla. When the growth of cells ceases within the hair follicles then permanent baldness is the result.

Sweat Glands, or sudoriparous glands, are found generally distributed throughout the skin, but are most abundant in the palms and soles, where they number 2,500 to 3,000 in each square inch. In the skin of the back, again, there are only between 400 and 500 in the square inch. Each gland consists of a ball-like body lying in the subcutaneous tissue, from which a tubular duct proceeds through the skin to open on its free surface. The ball is composed of a convoluted tube continuous with the tubular duct, and terminating in a blind end. The wall of the gland tube consists of a delicate nucleated membrane lined by columnar secreting cells. It is surrounded by connective tissue containing capillary blood-vessels.

The human body and the bodies of all the more highly organized animals are traversed by numerous tubes or pipes, technically called Vessels, some of which in man are nearly an inch in diameter, others so small as to require a microscope for their examination, others again of every intermediate size. In connection with the vessels is a central organ, the Heart. The heart and the vessels collectively constitute the Vascular System. Of these vessels some contain blood, and form the Blood-vascular system; others contain lymph, and form the Lymph-vascular system. The lymph-vascular system is not independent of the blood-vascular system, but communicates with it at several points. The vascular system is a hydraulic apparatus, possessing a pump, pipes, and valves. The heart is the pump, which works, not by the movements of a piston, but by the contraction of its muscular walls; the vessels are the pipes, which convey the contained fluid, and they are provided in certain localities with valves for modifying its flow.

The movement of the blood in the blood-vascular system is called the *circulation of the blood*. In the lower Vertebrata the heart is a single organ, and the blood flows from it through the vessels back again into the part of the heart from which it had proceeded, forming a *simple circulation*. In man and the higher vertebrates the heart is a double organ, *i.e.*, it consists of a right and left portion, intimately united to, but not directly communicating with, each other. The blood which flows from its right side passes through vessels which traverse the lungs, and is conveyed to the left side of the heart; while the blood which flows from the left side passes through vessels which traverse the body generally, and is conveyed to the right side of the heart. This is called a *double circulation*; that which appertains to the body generally is the *systemic circulation*.

The vessels which carry the blood away from the heart are called *arteries*; those which convey it back to the heart are *veins*. The arteries and veins do not communicate directly with each other, but through the intermediation of a network of extremely minute vessels, the *capillaries*. Hence, both in the pulmonary and systemic circulation, the blood in its passage from the arteries into the veins must go through capillaries. The blood which flows from the left side of the heart into the systemic arteries is pure or arterial blood; as it traverses the systemic capillaries it parts with certain of its constituents to nourish the organs and tissues, and as it receives from them waste products it becomes impure blood; in which condition it flows back to the right side of the heart by the systemic veins as venous blood; hence the right side of the heart is often called the venous side. The blood which flows from the right side of the heart along the pulmonary artery is this impure blood; as it traverses the pulmonary capillaries it is purified by the action of the air in the lungs, and is changed into arterial or pure blood, in which condition it flows back by the pulmonary veins to the left side of the heart, which consequently is called the arterial side. The object of the pulmonary circulation, therefore, is to reconvert into pure blood the blood which has been rendered impure during its passage through the systemic capillaries.

The Heart.—The heart is a hollow muscle contained in the cavity of the chest, and inclosed within a bag called the *Pericardium*. The pericardium, with its inclosed heart, occupies the space called *mediastinum*, between the two lungs; it lies therefore behind the sternum, and in front of the spinal column, but projects more to the left than to the right side of the mesial plane. The bag of the pericardium is formed externally of a strong fibrous membrane, which is attached below to the central tendon of the diaphragm, but blends above with the sheaths of the great vessels which pass to and from the heart. When the bag is cut open its inner surface is seen to possess a smooth glistening serous aspect, for it is lined by a layer of squamous endothelium, which layer is continuous with the serous membrane that invests the heart, and forms the visceral layer of the pericardium. The continuity of the serous lining of the bag with the serous investment of the heart takes place where the great blood-vessels pierce the fibrous bag.

The heart lies obliquely from above downward, from right to left, and from behind forward. For descriptive purposes it may be regarded as possessing a base, an apex, an anterior and a posterior surface, a right-and-left border. The base lies backward, upward, and to the right, opposite the fourth to the eighth dorsal vertebrae. The apex is directed forward, downward, and to the left, opposite to the interval between the fifth and sixth

left ribs. The heart has on its surface grooves which indicate its division internally into four chambers, two in its right half, two in its left half. The right chambers are the right auricle and the right ventricle. The left chambers are the left auricle and left ventricle. All these chambers are lined by a smooth membrane, the *endocardium*, which is continuous on the one hand with the lining membrane of the veins, on the other with the lining membrane of the arteries.

The *Right Auricle* occupies the right part of the base of the heart. It consists of a large dilated portion, the *sinus venosus*, and of a small ear-shaped appendage, the *auricula*. Its muscular wall is smooth internally, except in the auricula and adjacent anterior wall of the sinus venosus, where it is thrown into parallel ridges like the teeth of a comb, and named *musculi pectinati*. Into the sinus venosus open the great systemic veins or *venæ cavæ*. The *superior vena cava* conveys to the auricle the systemic blood that has been circulating in the body above the diaphragm; it opens by a patent mouth into the upper and back part of the sinus venosus. The *inferior vena cava* conveys to the auricle the blood that has been circulating in the parts of the body below the diaphragm; it opens into the lower and back part of the auricle, and at its mouth is a rudimentary valve, the *Eustachian valve*. Close to its orifice is the mouth of another large vein, the *coronary venous sinus*, which also possesses a small valve. Several minute openings, the *foramina Thebesii*, scattered over the inner wall of the auricle, are the mouths of small veins ramifying in the wall itself. Through these various orifices the venous blood pours into the auricle, and then flows into the right ventricle through a large orifice of communication between them. The right auricle is separated by a partition, the *auricular septum*, from the left auricle. On the surface of this septum is a depression, the *fossa ovalis*, surrounded by a raised border, the *annulus ovalis*, with which border the inner end of the Eustachian valve is continuous. Before the birth of the child the septum is perforated by a hole, called *foramen ovale*, through which the blood flows directly into the left auricle, but this foramen is obliterated after the birth of the child.

The *Right Ventricle* forms the right border, a large part of the anterior surface, but only a small part of the posterior surface of the heart. It is shaped somewhat like a flattened cone, its apex being directed downward toward the apex of the heart, its base to the corresponding auricle. The inner surface of its wall is very irregular, owing to the muscular bundles being elevated into strong ridges, called *columnæ carneæ*. Two, or it may be three, of these fleshy columns project like nipples or big papillæ into the cavity of the ventricle, and are called *musculi papillares*. Attached to the free apex of each papillary muscle are several fibrous threads, the *chordæ tendinæ*, which, by their opposite extremities, are connected to the segments of a large valve situated around the opening between the right auricle and ventricle. The right auriculo-ventricular opening, situated at the base of the ventricle, is sufficiently large to admit three fingers, and possesses a valve which consists of three large pointed segments or cusps (hence the name *tricuspid* given to it), between which three small intermediate cusps lie. One of the large cusps lies opposite the anterior wall of the ventricle, another opposite the posterior, while the third is between the auriculo-ventricular and pulmonary openings. The right ventricle is completely separated from the left by the *ventricular septum*, which passes obliquely from left to right, and from before backward, so that it forms the posterior wall of the right ventricle and the anterior wall of the left.

The *Left Auricle* occupies the left part of the base of

the heart, and, like the right auricle, consists of a dilated *sinus venosus* and an ear-shaped *auricula*. Its muscular wall forms a smooth surface internally, except in the auricula, where the ridge-shaped *musculi pectinati* occur. Opening into the sinus are the orifices of the four *pulmonary veins*, two from the right, two from the left lung; these orifices are without valves. At the lower part of the auricle is the large orifice of communication between it and the base of the left ventricle.

The *Left Ventricle* forms the left border, the apex, a large part of the posterior surface, but only a small part of the anterior surface of the heart. It is conical in form, its apex is at the apex of the heart, the base at the corresponding auricle. As in the right ventricle, the inner surface of its wall is elevated into fleshy columns, two of which project like nipples into the cavity and form *musculi papillares*, which have *chordæ tendinæ* connected with them. The left auriculo-ventricular opening is large enough to admit two fingers. It possesses a valve, which consists of two large pointed segments or cusps, between which two small intermediate cusps lie, hence it is called the *bicuspid valve*; and as these cusps are placed one in front of the other like the segments of a bishop's mitre, the name *mitral valve* is often given to it. The cusps agree in shape, general arrangement, and mode of attachment with those of the tricuspid valve, but they are stronger; and as the more anterior segment lies obliquely between the auricular and aortic orifices, both its surfaces are smooth. From the base of this ventricle the great systemic artery or *aorta* arises through the intermediation of a strong fibrous ring. The mouth of the aorta is surrounded by a three segmented *semilunar valve*, similar to the semilunar pulmonary valve, but with thicker and stronger segments, and possessing more strongly marked *sinuses of Valsalva*. The base of each ventricle has therefore two openings in it, one for communication with the auricle, the other with the great artery arising from the ventricle. The auriculo-ventricular openings are the most posterior, and almost in the same plane; the aortic opening lies in front of the interval between the two auriculo-ventricular, and the pulmonary opening is in front of the aortic.

The walls of the cavities of the heart are formed of striped muscular fiber, over the contractions of which the will exercises no control. The fibers are collected into fasciculi, which have a reticulated arrangement, and the fibers themselves branch and again unite to form a complicated network. The fibers of the walls of the auricles are distinct from those of the ventricles, so that the auricular and ventricular compartments are connected together, not by an interchange of muscular tissue, but by an intermediate ring-like arrangement of fibers of connective tissue. The muscular fasciculi of the auricles are arranged in two strata.

The muscular wall of the ventricles is much thicker than that of the auricles, and the wall of the left ventricle is about three times thicker than the right. The fibers vary in their direction in different parts of the thickness of the ventricular walls.

The heart is well supplied with blood, not by the blood which flows through its cavities, but by two special coronary arteries which ramify in its walls, and end in numerous capillaries lying between the fibers. From these capillaries the coronary veins arise, which join to form the coronary venous sinus. Lymphatic vessels occur both in the endocardium and pericardium, and apparently ramify in the muscular wall. The nerves of the heart have been dissected especially by Scarpa, Remak, Lee, and Pettigrew, and numerous small ganglia described in connection with them.

The blood flows along the great veins into the auricles, and is forced by the contraction of their muscular wall through the auriculo-ventricular openings, the valves of which open outward, into the ventricles. When the ventricles are distended their muscular walls contract and force the blood into the arteries—the right ventricle into the pulmonary artery, the left into the aorta—the valves at the mouth of each artery opening outward to allow of the free passage of the fluid. To prevent, during the ventricular contraction, the regurgitation of blood into the auricles, the auriculo-ventricular valves are floated away from the sides of the ventricle across their respective openings, and by the apposition and slight overlapping of their edges temporarily close the openings. The tilting upward of the valves into the auricles is prevented by the contraction of the muscoli papillares, and their connection with the cusps of the valve through the chordæ tendineæ.

The regurgitation of the blood into the ventricles is prevented by the closure of the semilunar valves, the segments of which are thrown across the arterial orifices through the pressure exercised on the column of blood in the lumen of the artery and in the sinuses of Valsalva.

The Arteries.—These vessels were named arteries by the older anatomists, on the supposition, now known to be erroneous, that they contained air. The term is now employed to express a blood-vessel, which, arising either directly or indirectly from the heart, conveys blood away from that organ. Arteries divide and subdivide into smaller vessels in their course, and to the individual branches descriptive names are applied. Some of these names express the position of an artery, as subclavian, axillary; others, the organ in which it is distributed, as pulmonary, hepatic; others a peculiarity in its course, as circumflex, coronary. The branches of arteries may be either *collateral* or *terminal*. The collateral branches arise from the sides of the parent artery either at an acute, a right, or an obtuse angle. Terminal branches arise at an acute angle by the bifurcation of the parent artery, which is the most common form, or by the breaking up of the artery into a cluster of branches. Branches which arise either from the same artery or from different arteries may be distributed in a common locality, may there unite together, and form what is called an *inosculation* or *anastomosis*, so that the blood from one artery may thus flow from it into another. The most common anastomosis is by the formation of loops between adjacent branches, but sometimes, as when the two vertebral arteries join to form the basilar, a convergence of two almost straight arteries takes place; and in other cases, as where the two anterior cerebral arteries are joined together by the anterior communicating, a connecting branch passes transversely across the mesial plane. A more complex form of anastomosis is when an artery (and a similar arrangement is sometimes found in veins) rapidly subdivides into numerous branches, which may again join to form a trunk either with or without the formation of a plexus. This is called a *rete mirabile*, an arrangement not uncommon in the cetacea, in the internal carotid arteries of ruminants, in the mesenteric arteries of the pig, in the arteries of the limbs of the sloths and lemurs, and in the arterial system of fishes. The only examples of a rete in the human body are the convoluted Malpighian tufts of the kidney and the arterial distribution in the coccygeal body.

The distribution of the pulmonary artery will be considered in the anatomy of the lungs. That of the aorta will now be briefly described.

The *Aorta* lies in the cavities of the thorax and abdomen, and arises from the base of the left ventricle. It

ascends forward, upward, and to the right as far as the level of the second right costal cartilage, then runs backward and to the left to reach the left side of the body of the fourth dorsal vertebra, and then descends almost vertically to reach the left side of the body of the fifth dorsal vertebra. It forms, therefore, an arch, well known as the *arch of the aorta*, which arches over the root of the left lung, and which has attached to its concave surface a fibrous cord, known as the obliterated *ductus arteriosus*, which connects it with the left branch of the pulmonary artery. The aorta continues its course downward in close relation to the bodies of the lower dorsal vertebræ, then passes through an opening in the diaphragm, enters the abdomen, and descends in front of the bodies of the lumbar vertebræ as low as the fourth, where it is usually described as dividing into the two terminal branches, the common iliac arteries. At the angle of bifurcation, however, a long slender artery, called the *middle sacral*, is prolonged downward in front of the sacrum to the end of the coccyx. The branches which arise directly from the aorta may be arranged in four groups.—1st, Branches for the supply of the viscera of the thorax and abdomen proper; 2d, branches for the walls of the thorax, abdomen, and pelvis; 3d, branches for the head, neck, and upper limbs; 4th, branches for the lower limbs, pelvic walls, and viscera.

The branches of the aorta which supply the viscera of the thorax are the coronary, the œsophageal, the bronchial, and the pericardial. The *coronary* arteries, two in number, are the first branches of the aorta, and arise opposite the right and left segments of the semilunar valve, from the wall of the aorta, where it dilates into the sinuses of Valsalva. The mouths of these arteries are closed by the opening outward of the aortic valves during the ventricular contraction. The elastic recoil of the aorta following that contraction not only closes the aortic valves, but drives the blood into the coronary arteries. These arteries break up into branches in the muscular walls of the heart, and the sudden turgescence of its walls, which results from the filling of these vessels, is, according to Brücke and Garrod, the cause of the dilatation of the ventricular cavities.

The *bronchial* arteries are two in number; one accompanies each bronchial tube, and supplies the tissues of the lung.

The *œsophageal* arteries, three or four in number, supply, the coats of the œsophagus.

The *pericardial* branches are very small arteries which supply the back of the bag of the pericardium.

The branches of the aorta which supply the viscera of the abdomen arise either singly or in pairs. The single arteries are the cœliac axis, the superior mesenteric and the inferior mesenteric, which arise from the front of the aorta; the pairs are the capsular, the two renal, and the two spermatic or ovarian, which arise from its sides. The single arteries supply viscera which are either completely or almost completely invested by the peritoneum, and the veins corresponding to them are the roots of the vena portæ.

ANAXAGORAS was born about 509 B. C., at Claromena, in Asia Minor. He removed to Athens where he continued thirty years, but was forced to retire to Lampascus, where he died about 428 B. C. Anaxagoras marks a turning-point in the history of philosophy. With him speculation passed from the colonies of Greece to settle at Athens. By the theory of minute constituents of things, and his emphasis on mechanical processes in the formation of order, he paved the way for the Atomic theory. By his enunciation of the order that comes from Reason, on the other hand,

he suggested the theory that nature is the work of Design. But the features of this Reason he described in a vague and analogical way.

ANAXARCHUS, a Grecian philosopher of the Eleatic school, was born in Abdera, and flourished about 340 B.C. He was the companion of Alexander in his expedition into Asia, and seems, from anecdotes that have been preserved, to have enjoyed his intimate friendship. He checked the vainglory of Alexander, when, elated with pride, he aspired to the honors of divinity, by pointing to his wounded finger, saying, "See the blood of a mortal, not of a god."

ANAXILAUS of Larissa, a physician and Pythagorean philosopher, was banished from Rome by Augustus, B.C. 28, on the charge of practising the magic art.

ANAXIMANDER, the second of the physical philosophers of Ionia, belonged, like his predecessor Thales, to the city of Miletus. His biography is a blank. The computations of Apollodorus have fixed the year of his birth at 611, and of his death a short while after 547 B.C. Tradition, probably correct in its general estimate, represents him as a successful student of astronomy and geography, and as one of the pioneers of exact science among the Greeks.

ANAXIMENES of Miletus may have been a younger contemporary of Anaximander, whose pupil or friend the ordinary tradition represents him to have been. To him it seemed that the air, with all its variety of contents, its universal presence, and all the vagueness which it has for the popular fancy as the apparent source of life and growth, was what maintained the universe, even as breath, which is our life and soul, sustains us.

ANAXIMENES, a Greek historian and rhetorician, was born at Lampsacus, in Asia Minor, in the 4th century B.C. He accompanied Alexander, whom he is said to have instructed in rhetoric, on his expedition against Persia.

ANCELOT, JACQUES ARSÈNE FRANÇOIS POLYCARPE, a French dramatist and *littérateur*, was born at Havre, 9th Feb. 1794, and died 7th Sept. 1854. He completed his studies at Paris, where he made his literary début in 1819, with *Louis IX.*, a five-act tragedy, of which three editions were speedily exhausted. It had a run of fifty representations, and brought him a pension of 2000 francs from the king, Louis XVIII.

ANCHISES, in *Greek Legend*, son of Capys and grandson of Assaracus, his mother being Themis, a daughter of Ilus, the founder of Ilium or Troy, to the ruling family of which, at the time of the Trojan war, he was also, on the paternal side, related, since Assaracus had been a brother of Ilus. From the Assyrian character of the name Assaracus, from the intercourse between the Phœnicians and the early inhabitants of the Troad, and from the connection of Venus, the protecting goddess of the Phœnicians, with Anchises, it has been inferred that the family of the latter had originally come from somewhere near the centre of Assyrian influence. He was the father of Æneas.

ANCHOR, in *Navigation*, a crook or hook, an instrument of iron or other heavy material used for holding ships in any situation in which they may be required to lie, and preventing them from drifting by the winds or tides, by the currents of rivers, or any other cause. This is done by the anchor, after it is let down from the ship by means of the cable, fixing itself into the ground, and there holding the vessel fast. The anchor is thus obviously an implement of the first importance in navigation, and one on which too much attention cannot be bestowed in its manufacture and proper construction, seeing that on it depends the safety of the vessel in storms. The invention of so necessary

an instrument is to be referred, as may be supposed, to the remotest antiquity. The most ancient anchors consisted merely of large stones, baskets full of stones, sacks filled with sand, or logs of wood loaded with lead.

Up to the commencement of the present century what was termed the "old plan long-shanked" anchor seems to have been generally used. It was made of wrought iron, but the appliances of the anchor smith were so crude that little dependence could be placed upon it.

The size of anchors for various ships has been determined by practice, but is based upon the theory that as the anchor is required to withstand the force brought upon the ship by the wind and tide, which would otherwise cause her to drift, its strength must be nearly proportional to her resistance.

A large ironclad carries 8 anchors,—2 bower, 2 sheet, 1 stream, 1 stern, and 2 kedge.

Mooring anchors are those which are placed in harbors, &c., for the convenience of vessels frequenting them. A large *buoy* is attached to the end of the mooring cable, and the ship is made fast to a ring-bolt fitted on the buoy. Mooring anchors are not limited by considerations of weight, &c., as other anchors are, the only requirements being that they have sufficient holding power, and do not project above the ground, as any projection in the shallow waters in which they are usually placed would render ships liable to injury from grounding on them, and be dangerous to fishing-nets, &c.

A good anchorage is where there are from 10 to 20 fathoms of water, and the ground is not rocky or loose sand. Where there are more than about 20 fathoms the cable bears too nearly perpendicular, and is liable to trip the anchor. For anchoring in ordinary weather the length of cable veered out is about three times the depth of water.

ANCHOVY (*Engraulis*, Cuv.), a family of small fishes akin to the shad and the sprat, all three being of the *Clupeide*, or Herring tribe. There are six or seven species of anchovy found in the seas of Europe, of tropical America, and of India. Of these the most important and the largest is the common anchovy, *Engraulis encrasicolus*, so called from the bitter taste of its head, and the ancient belief that its bile was in that part. From the days of the Greeks and Romans it has been esteemed for its delicate and unique flavor.

ANCHYLOSIS, or ANKYLOSIS (from bent, crooked), stiffness of a joint, the result of injury or disease. The rigidity may be complete or only partial, and may be due to disease of the tendinous or muscular structures outside the joint, or to disease of the joint itself.

ANCILLON, CHARLES, son of David Ancillon, and one of a distinguished family of French Protestants, was born 28th July 1659, at Metz, and died, 5th July 1715, at Berlin. He studied law at Marburg, Geneva, and Paris, where he was called to the bar. At the request of the Huguenots of his native place, he pleaded their cause at the court of Louis XIV., urging that they should be excepted in the revocation of the Edict of Nantes.

ANCILLON, DAVID, an eminent French Protestant divine, father of the preceding, was born, 17th March 1617, at Metz, and died, 3d September 1692, at Berlin.

ANCILLON, JOHANN PETER FRIEDERICH, a historian and Prussian statesman, one of the family of French Protestant refugees noticed above, was born at Berlin, 30th April 1766, and died there, 19th April 1837. Descended from a family of divines, he early selected the ecclesiastical profession, and studied theology first at Berlin and then at Geneva. Ancillon took rank among the most famous historians of his day by his work, *A Picture of Political Revolutions in Europe since the*

Fifteenth Century, which gained him the eulogium of the Institute of France, and admission to the Royal Academy of Berlin. Soon after the revolution of July, 1830, he was made minister of foreign affairs, with the entire control of the whole department; and he retained the title of minister of state till his death.

ANCONA, a province of the kingdom of Italy, bounded on the north by the Adriatic Sea and the province of Pesaro-Urbino, on the west by Pesaro-Urbino and Umbria, on the south by Macerata, and on the east by the Adriatic. It forms part of the old district of the Marches, which passed from the dominion of the Pope to that of Victor Emmanuel in 1860.

ANCONA, a city of Italy, and capital of the province of the same name, is pleasantly situated on the Adriatic, 132 miles northeast of Rome, in a sort of amphitheatre between two hills. The manufacture of silk is important. The population (1901) was 56,825.

ANCRE, **BARON DE**, marshal of France, was born in Florence, Italy, and came to the French court in 1600, in the train of Marie de' Medici. He rose to great honors and was made marshal, although not a soldier, but he was detested by the people, and on April 24, 1617, he was assassinated at the Louvre and his body buried before the statue of Henry IV.

ANCUS, MARCIUS, the fourth king of the Romans, succeeded Tullus Hostilius about 638 B. C., and reigned until 614.

ANCYRA. See **ANGORA**.

ANDALUSIA, or **ANDALUCIA**, an extensive region in the south of Spain, bounded on the north by New Castile and Estremadura, on the west by Portugal, on the south by the Atlantic and the Mediterranean, and on the east by the Mediterranean and Murcia. Although no longer officially recognized, yet, like the other ancient divisions of Spain, it is probably better known and oftener referred to, at least in popular language, than the modern provinces which have been formed out of it. The name Andalusia is said to be a corruption of Vandalusia, from the Vandals, who overran this part of Spain after the downfall of the Roman Empire; other authorities, however, consider that the Moors, who occupied the country after the Vandals, gave it its present name from their term *Andalosh*, "land of the West." Andalusia has an area of 33,000 square miles, and has a population of about 3,500,000.

ANDALUSITE, a mineral consisting of silicate of alumina, found chiefly in metamorphic rocks.

ANDAMAN ISLANDS. These islands lie in the Bay of Bengal, 590 geographical miles from the Hoogly mouth of the Ganges, 160 miles from Cape Negrais in Lower Burma, the nearest point of the mainland, and about 340 from the north extremity of Sumatra. Between the Andamans and Cape Negrais intervene two small groups, Prepara and Cocos; between the Andamans and Sumatra intervene the Nicobar Islands, all seeming to indicate a submarine range stretching in a curve, to which the meridian forms a tangent, between Cape Negrais and Sumatra; and though this curved line measures 700 miles, the widest sea-space is less than 90.

ANDANTE (Italian), in music, implies a movement somewhat slow and sedate, but in a gentle and soothing style.

ANDELYS (LES), a town in the department of Eure, France, formed by the union of *Le Grand* and *Le Petit* Andely, which are situated, the latter on the eastern banks of the Seine, and the former nearly half a mile from the river, at a distance of about twenty miles northeast of Evreux. Population, 4,000.

ANDENNE, a town of Belgium, in the province of Namur, situated on the right bank of the Meuse, ten miles east of Namur. Population, 7,620.

ANDERNACH, a small town of Rhenish Prussia, situated on the left bank of the Rhine, 10 miles northwest of Coblenz. It is the *Antunnaconum* of the Romans, and in the Middle Ages was a fortified town of considerable importance, but at the present day the walls only add to its picturesque appearance. Pop., 6,000.

ANDERSON, ADAM, a Scottish economist, was born in 1692, and died in London on the 10th of January 1765.

ANDERSON, ALEXANDER, an eminent mathematician, was born at Aberdeen, Scotland, about 1582. The works of Anderson amount to six thin 4to volumes, which are now very scarce. As the last of them was published in 1649, it is probable that the author died soon after that year, but the precise date is unknown.

ANDERSON, SIR EDMUND, a younger son of an ancient Scottish family settled in Lincolnshire, was born at Broughton or Flixborough about 1540, and died in 1605.

ANDERSON, JAMES, LL.D., was born at the village of Hermiston, in the county of Edinburgh, in the year 1739. Dr. Anderson, after a general decline, partly occasioned by excessive mental exertion, died in 1808.

ANDERSON, JAMES, a learned and industrious antiquary of Edinburgh, was born August 5, 1662, and educated to the legal profession, in which he became a writer to the Signet. His reputation as a historian stood so high, that just before the Union the Scottish parliament commissioned him to prepare for publication what remained of the public records of the kingdom, and in their last session voted a sum of £1940 sterling to defray his expenses. At this work he labored for several years with great judgment and perseverance; but it was not completed at his death in 1728.

ANDERSON, JOHN, natural philosopher, was born at Roseneath in Dumbartonshire in 1726. In 1756 he became professor of Oriental languages in University of Glasgow, where he had finished his education. He opened a class for the instruction of mechanics in the principles of their arts, in which his familiar extempore discourses were illustrated by appropriate experiments. He is thus to be regarded as the father of those Mechanics' Institutions which have since become so common. His anxiety for the improvement of artisans was not confined to his personal exertions. Shortly before his death in 1796, he bequeathed the whole of his property to eighty-one trustees, for the purpose of founding an institution for educational purposes in Glasgow.

ANDERSON, ROBERT, an author and critic of considerable note in his own day, was born at Carnwath, Lanarkshire, Scotland, on January 7, 1750, and died in 1830.

ANDERSON, capital of Madison county, Indiana, and a leading industrial and railroad center, is situated on the White river, also on the Pittsburgh, Cincinnati, and St. Louis; C., C., and I.; the Midland and the Wabash and Michigan railroads. It has three banks, two daily and three weekly papers, five churches, and a well-organized and liberally-maintained school system. Its population in 1890 was 10,759.

ANDERSONVILLE, a hamlet in Sumter county, Ga., the site of a large Confederate prison for Union soldiers during the Civil war. It has good railway facilities, and contains two churches, schools, stores, etc. Near the village is a large National cemetery in which lie the prisoners who died in confinement.

ANDES. The Andes form a mountain chain second

only to the Himalayas in the vastness of its proportions, and possessing many remarkable peculiarities. The origin of the name appears to be unknown, although numerous meanings have been authoritatively assigned to it. Humboldt believes its meaning has been lost.

The Andes form a continuous belt of mountainous highland along the western margin of South America, and have been considered by many writers as the southern continuation of the Rocky Mountains, which form a similar belt along the west side of North America. There are many objections against this view, and in favor of that which makes the Andes and Rocky Mountains two distinct ranges. In New Granada, or Colombia, as it is now called, the eastern range of the Andes terminates on the western side of the Gulf of Maracaybo, near 72° W. long. South of the gulf a branch range is thrown off, which traverses Venezuela. The central range dies out in the low lands south of the junction of the Cauca and Magdalena rivers. The western range also lowers and spreads in breadth in advancing northwards, and is lost in the low flats along the south margin of the Gulf of Darien. At the neck of the Panama isthmus, the Naipi and Cupica valleys stretch from the Atlantic to the Pacific Ocean, and are nowhere more than a few hundred feet above the level of the sea. North of the Atrato a serpentine ridge of mountains occurs, which terminates in Cape Tiburon. It is crossed by a pass called Tanela, which is about 5 miles in length, and 130 feet above the sea. Most of the isthmus between 8° and 9° N. lat. is below the level of this pass. Here the Isthmus of Panama curves round westwardly; and west of Panama there is another broad low tract stretching right across. This district cannot be regarded as belonging in any way to the Andes. In Central America the mountains form numerous isolated ranges. In Mexico there are two high sierras. The eastern sierra does not reach the Rio Branco. The western sierra terminates at its north end in the Sierra Madre de Durango, which dies out in the northern part of Chihuahua and in Sonora, without being in any way connected with the Rocky Mountains.

The Rocky Mountains commence in about 100° W. long. at their south end, and terminate in about 145° W. at the north end, and have a general north-westerly direction. The Andes, on the other hand, commence near 54° S. lat. and 70° W. long. The southern portions form a gentle curve, bending round to 73° W. in Patagonia, and reaching 70° again in the south of Chili. It continues on this line to Coquimbo, where it bends easterly, and after a slight double curve it cuts the meridian of 70° again south of Lake Titicaca. There is then a sharp bend, corresponding to that in the coast, which carries the range nearly to 80° W. in Ecuador, beyond which it again has an easterly bend, so as to cause it to terminate between 72° and 76° W. The north and south ends are consequently nearly in the same meridian. There are other dissimilarities between the Andes and the Rocky Mountains.

The formation of the Andes is due to several causes operating at distinct intervals of time. They consist mainly of stratified material which has been more or less altered. This material was deposited at the bottom of a sea, so that at some former time the highest portions were submerged, probably in consequence, to a certain extent, of subsidence of the sea bottom. Since the latest deposits there have been upheaval and denudation. The range, then, has resulted from the accumulation of sediment on a subsiding area; from the subsequent upheaval of such deposits, which have been increased in height by the ejection of volcanic products; and from the operation of denuding agents.

As far as our present knowledge goes, it appears to

be probable that the Andes mark an area on which sedimentary deposits have been accumulated to a greater thickness than on any other portions of South America. It is further demonstrable that these deposits belong to several geological periods, the elevation having occurred at different periods, while their axes extend in different directions.

The range may be considered as commencing on the south with Cape Horn, although for several degrees it is much broken up by arms and straits of the sea. The first portion of any extent commences between Cape Good Success and Cape San Paulo, and stretches across Tierra del Fuego, by Mount Darwin and Mount Sarmiento, and the range of hills on either side of Admiralty Sound. The mountains named are from 6600 to 6800 feet high. The Strait of Magellan also cuts through and across the range, isolating the mountainous islands of Clarence and Santa Ines. Otway Water cuts through the range, and penetrates to the plain of Patagonia. North of this are several snowy eminences, and in some places glaciers descend almost to the sea-level. At Last Hope Inlet, or a little north of 52° S., we have the commencement of the Andes as a continuous range, Disappointment Bay being the most northern place where the Pacific reaches the plains to the east of the Andes. South of this, and for several degrees to the north, the islands which fringe the coast have a mountainous character, and appear to belong essentially to the Andes range, with which there is reason to believe they were once connected. Along this space the Andes encroach upon the ocean, and have no western slope proper. Many of the sea channels are very narrow and ravine-like in character; they appear to represent a valley between two ridges of mountains,—a feature which is most conspicuous farther north. The highest part or crest of the range is close to the sea, and consequently the streams which fall into the Pacific are all small. Towards the south the width is about 20 miles; and in the latitude of Mount Stokes, which is 6400 feet high, it is 40 miles. North of this the range is in places more than 40 miles across. From 46° to 42° S., the mountains become somewhat higher, the loftier peaks ranging from 4000 to 8000 feet. Among the more conspicuous are Mount Yanteles, 8030 feet; Mount Melimoyu, 7500 feet; Mount Corcovado, 7510 feet; and Mount Minchinmadda, 7406 feet above the sea-level. At about 30° S. the mountainous system becomes more complicated, owing to the appearance of several ranges which rise out of the plains towards the north-west corner of the Argentine Confederation, some of which run north and join the lofty highlands of the Bolivian Andes. It is doubtful whether all strictly belong to the Andes.

The highest peak is the Nevado de Sorata, close to Lake Titicaca, and estimated at 21,286 feet high; next to it comes the twin peaked Illimani, a little further south, which rises to 21,181 feet. The passes crossing the valley have summits averaging 14,000 feet, but the one which skirts the Nevado de Sorata rises to nearly 16,000 feet above the sea. From about 18° S. the Andes, like the coast, runs northwest, so that whereas in about 18° S. the crest of the western Cordillera is in 70° W. long., at 14° S. it has reached a little beyond 75° . Here there is another change of direction, this portion of the western Cordillera stretching from about 14° S. to 6° S., the south end being near 75° W., and the north near 80° W., the wasting being rather more than half a degree per degree of latitude. The northern end of the eastern Cordillera is near 72° W. Returning again to the Peruvian Andes, we find some lofty peaks which rival, and it may be surpass, those of Bolivia. Thus Seshama is reputed to be 22,000 feet; Chungara somewhat less;

Chipicani, 18,898 feet; Arequipa, 18,373; Chuquibamba, 21,000 feet. The two Cordilleras are again united in the north by the mountain knot of Los Pastos, on the borders of Ecuador and Colombia. The valley plains are about 40 miles wide. On the south is the valley of Cuenca, which is about 50 miles long, and about 7800 feet above the sea. From it the way into the central valley plain, that of Ambato, is across the transverse ridge by the pass of Assuay, which rises to 15,520 feet. It is about 130 miles long, and about 8000 feet above the sea. The mountain fringe comprises several important volcanoes, viz., Sangay, Tunguragua, and Cotopaxi in the eastern Cordillera; and the volcano Carguizazo in the western Cordillera, which also includes the lofty Chimborazo, estimated to reach 21,424 feet above the sea. Then crossing over the low transverse ridge of the Alto de Chisínche, we descend into the valley-plain of Quito, which is bordered by one of the most intensely volcanic areas on the globe. To the east are Sinchulagua, Antisana, and Cayambe; the last is now extinct, stands on the equator, and is 19,534 feet above the sea. It is the highest point on the equator in the globe, and is the only one along that line where perpetual snow exists. In the western Cordillera the prominent eminences are Pichincha and Imbabura. The valley-plain is about 9500 feet above the sea. Chimborazo is the most conspicuous feature in this part of the Andes, and from one point its outline resembles that of a lion at rest. Cotopaxi is the most symmetrical active volcano on the globe. Its apical angle is $122^{\circ} 30'$; and the slope is a little over 30° on the south, west, and east sides, and nearly 27° on the north side. Its summit was attained for the first time on November 27, 1872, by Drs. Reiss and Stübel. The height was found to be about 19,500 feet. Beyond the mountain knot of Los Pastos two Cordilleras run in a north-easterly direction to about 2° N. The western Cordillera is broken by the valley of the Patia, which has its source on the slopes of the valley between the mountain knot of Los Pastos and the transverse ridge south of Popayan. The eastern Cordillera is continued into the Paramo de Guanacas, from which basis the Andes spread out fan-like into three Cordilleras. This paramo, like the cross range between Iliniza and Cotopaxi, forms part of the main watershed between the rivers draining into the Atlantic and Pacific Oceans. North of the paramo this watershed runs along the western Cordillera for some distance, and then crosses several minor ranges of hills with their intervening valleys. The low watersheds at the head of the Atrato basin coincide with it.

ANDESITE, a group of volcanic rocks, gray, reddish or dark-brown in color, and occurring chiefly in the Tertiary and more recent formations.

ANDIRONS, otherwise known as fire-dogs, are articles of domestic furniture formerly used for burning wood on an open hearth and consisting of a horizontal bar raised on short supports with an upright standard at one end. Of late years there has been a revival of this old fashion and ornamental andirons of brass or copper are to be seen in many instances in the more fashionable residences.

ANDOCIDES, a Greek orator and diplomatist, was born at Athens in 467, and died about 391 B.C. After holding a command for a time in the Athenian fleet, he was engaged in various embassies to foreign states. In 415 he was implicated with Alcibiades in the charge of mutilating the busts of Hermes, suspicion being specially roused against him from a large bust near his house having been almost the only one that was left entire.

ANDORRE, or **ANDORRA**, a small semi-independent state on the south side of the Pyrenees, between the Spanish province of Lerida and the French department

of Ariège. It is surrounded by mountains, and consists of one main valley, which is watered by the Balira, a tributary of the Segre, which itself flows into the Ebro, and of several smaller valleys, the most important of which are those of the Ordino and the Os. It has an area of about 600 square miles, and is divided into six parishes, Andorra la Viéja (the capital), San Julian de Loria, Canillo, Encamp, Ordino, Massana. The population is 6,000. The territory was once densely wooded, whence probably its name, from the Arabic *Aldarra*, "a place thick with trees;" but the forests have been almost entirely destroyed for fuel. The pasturage is extensive and excellent; the mountains contain iron and lead mines; rye, potatoes, fruits, and tobacco, are grown on the lower grounds; game and trout are abundant.

ANDOVER, an ancient market-town in the north-west of Hampshire, situated near the left bank of the river Anton, 63 miles from London, and 12 from Winchester. It is well built, and contains a large parish church—erected about forty years ago on the site of the old one, which existed in the time of William the Conqueror—several dissenting places of worship, various elementary schools, and a spacious town hall.

ANDOVER, a post township of Essex county, Massachusetts, U. S., pleasantly situated on the southern bank of the Merrimac river, 21 miles north of Boston. It contains one of the most celebrated theological seminaries in the United States. It takes its name from Andover, England, from which place most of its settlers came. Its population in 1900 was 6,813.

ANDRADA, **DIEGO PAYDA D'** (born at Coimbra in 1528, died 1575), a learned Portuguese theologian, who distinguished himself at the Council of Trent, to which he was sent by King Sebastian.

ANDRADA E SYLVA, **BONIFACIO JOZÉ D'**, a distinguished Brazilian statesman and naturalist, was born at Villa de Santos, near Rio Janerio, 1765, and died at Nichteroy, 1838.

ANDRÉ, **JOHN**, an accomplished soldier, who has gained a place in history by his unfortunate end, was born in London, in 1751, of Genevieve parents. Accident brought him in 1769 to Litchfield, where, in the literary circle of Miss Anna Seward, he met Miss Honora Sneyd. A strong attachment sprung up between the two; but their marriage was disapproved of by Miss Sneyd's family, and André was sent to cool his love in his father's counting-house in London. Business was, however, too tame an occupation for his ambitious spirit, and in March 1771 he obtained a commission in a regiment destined for America, the theatre at that time of the war of independence. Here his conduct and acquirements gained him rapid promotion, and he became in a few years aide-de-camp to the commander-in-chief of the British forces, Sir Henry Clinton, who had so high an opinion of him, that in 1780 he raised him to the post of major and adjutant-general of the forces. While André was in this situation, the American general, Arnold, who had displayed much energy in the cause of the colonies, conceiving himself injuriously treated by his colleagues, made a proposition to the British to betray to them the important fortress of West-Point, on the Hudson River, the key of the American position. This seemed a favorable opportunity of concluding the war, and Major André was appointed to negotiate with Arnold. For this purpose he landed from a vessel bearing a flag of truce, and had an interview with Arnold; but before the negotiations were finished, an American fort had fired on the vessel, and forced her to drop down the river. André, therefore, could not return by the way he came, and it was necessary to pass the night within the American lines at the house of his guide,

Smith, and set out next day by land for New York. Both were provided by Arnold with passports, and succeeded in passing the American outposts undetected. Next day, however, just when all danger seemed to be over, and Smith had left André in sight of the English lines, André was stopped by three militiamen of the enemy and carried back a prisoner. Washington sent him before a court-martial, and notwithstanding a spirited defense, and the remonstrances of the British general, who did all he could to save him, Major André was executed at Tappan as a spy on October 2, 1780—a sentence perhaps justified by the extreme rigor of martial law, as he had been in disguise within the lines of the enemy; but the traitor Arnold, through the address of poor André, escaped by timely flight the punishment he justly merited. Besides courage and distinguished military talents, Major André possessed a well-cultivated mind. He was a proficient in drawing and in music, and showed considerable poetic talent in his humorous *Cow-chase*, a kind of parody on *Chevy-chase*, which appeared in three successive parts at New York, the last on the very day of his capture. One of his first letters gives an affecting incident relating to his first love. When stripped of everything by those who seized him, he contrived to retain the portrait of Miss Sneyd, which he always carried on his person, by concealing it in his mouth. He was not aware that this lady had breathed her last some months before. His unhappy fate excited universal sympathy both in America and all over Europe, and the whole British army went into mourning for him. A mural sculptured monument to the memory of Major André was erected in Westminster Abbey by the British Government in 1821, and a movement was recently inaugurated to erect a monument to his memory on the scene of his capture.

ANDREA, GIOVANNI, the most famous Italian canonist of the fourteenth century, was born at Mugello, near Florence, about 1275. He studied canon law at Bologna, where he distinguished himself in this subject so much that he obtained a professorship of law, first at Padua, then at Pisa, and lastly at Bologna. Andrea is said to have died at Bologna of the plague in 1348. He wrote the following: *Gloss on the Sixth Book of the Decretals; Glosses on the Clementines; Commentary on the Rules of Sextus*.

ANDREANI, ANDREA, a celebrated engraver on wood, in Chiroscuro, was born at Mantua about 1540, and died at Rome in 1623. His engravings are scarce and valuable, and are chiefly copies of Mantegna, Dürer, and Titian.

ANDREASBERG, a town of Prussia, in the former kingdom of Hanover, situated in the Hartz mountains, at an elevation of nearly 2,000 feet above the level of the sea, and at a distance of about ten miles southeast from Clausthal.

ANDREEVA, or ENDERI, a town of Russia, in the district of the Caucasus, situated on the Aktash, forty-five miles south of Kizliar. Population, 12,000.

ANDREOSI, ANTOINE-FRANCOIS, COMTE D', a very distinguished French officer, was born at Castelnau in Languedoc, March 6, 1761, and died at Montauban, September, 1828. He was of Italian extraction, and his grandfather, François Andreossi, had taken part with Riquet in the construction of the Languedoc canal in 1669. At the age of twenty he became a lieutenant of artillery, and he early joined the republican party. He accompanied Bonaparte to Egypt as a *chef de brigade*, serving with great distinction, and was selected as one of Napoleon's companions on his unexpected return to Europe. After the battle of Waterloo he finally quitted the scene of political life,

relieving the tedium of retirement by writing several scientific memoirs. He was a man of solid and extensive requirements.

ANDRES, JUAN (1740-1817), an erudite Jesuit, born in Valencia, and some time professor of literature in the university of Gendia. He is the author of a great number of treatises on science, music, the art of teaching the deaf and dumb, etc.

ANDREW, St., the apostle, born at Bethsaida in Galilee, brother to Simon Peter. He had been a disciple of John the Baptist, and followed Jesus upon the testimony given of Him by the Baptist.

ANDREWES, LANCELOT, D. D., Bishop of Winchester, one of the most illustrious of the prelates of England, was born in 1555, in Thames street, Allhallows, Barking, London. In 1588 he succeeded Crowley in the vicarage of St. Giles, Cripplegate. On July 4, 1601, he was appointed dean of Westminster. July 25, 1603, he assisted at the coronation of James I, took part in the Hampton Conference of 1604, and was one of the committee to whom we owe our authorized version of the Holy Scriptures. He died at Winchester September 25, 1626.

ANDREWS, JAMES PETTIT, an English historian and miscellaneous writer, was the youngest son of Joseph Andrews, of Shaw-house, near Newbury, Berks, where he was born in 1737. Andrews was the author of several miscellaneous works, but his most extensive undertaking was his *History of Great Britain, connected with the Chronology of Europe, with Notes, etc.*, of which, however, he lived to complete but two volumes. He died at Brompton August 6, 1797.

ANDREW, JAMES O., Bishop of the Methodist Church, was born in Georgia, May 3, 1794. The fact that he was a slave-holder was the cause of the separation of the American Methodist Church, in 1844, into two bodies, which was an important factor in preparing the way for the American civil war. He died March 1, 1871.

ANDRIA, a town of Italy, in the province of Terra di Bari, situated in a plain three miles west of Bari. The town is said to derive its name from the caverns in the vicinity, is well built and possesses a fine cathedral, founded in 1046. It has no manufactures of importance, but there is an extensive trade in almonds, which are imported in large quantities from the surrounding country. Andria was burned in 1799 by General Broussier, and in 1861 it became part of the new kingdom of Italy. Its population is estimated at about 34,000.

ANDRIEU, BERTRAND, a celebrated engraver of medals, born November 24, 1761, at Bordeaux. Many of his medals are figured in the *Medallie History of Napoleon*. He died at Paris December 6, 1822.

ANDRISCUS, a man of mean extraction, who, pretending to be the natural son of Perseus, last king of Macedonia, assumed the name of *Philip*, for which reason he was called *Pseudo-Philippus*, the false Philip. Andronicus was put to death by order of the senate.

ANDROCLUS, a Roman slave who used to lead about the streets a lion that had forborne to injure him when turned loose upon him in the circus.

ANDROMACHE, in Greek legend, was the wife of Hector (*Iliad*, vi. 395), and daughter of Eëtion, prince of Thebe in Mysia.

ANDROMEDA, in Greek legend, the daughter of Cephus and Cassiopea, or Cassiepea, king and queen of the Æthiopians.

ANDRONICUS I (COMNENUS), Emperor of Constantinople, son of Isaac, and grandson of Alexis I. Comnenus was born about the beginning of the twelfth century. He was endowed by nature with the most

remarkable gifts both of mind and body. He was handsome and eloquent, but licentious; and at the same time active, hardy, courageous, and an excellent soldier. His early years were spent in alternate pleasure and military service. In 1141 he was taken captive by the Turks-Seljuks, and remained in their hands for a year. On being ransomed he went to Constantinople, where was held the court of his cousin, the emperor Manuel, with whom he was a great favorite. Here the charms of his niece, the princess Eudoxia, attracted him. She became his mistress, while her sister Theodora stood in a similar relation to the emperor Manuel. In 1152, accompanied by Eudoxia, he set out for an important command in Cilicia. Failing in his principal enterprise, an attack upon Mopsuestia, he returned, but was again appointed to the command of a province. This second post he seems also to have left after a short interval, for he appeared again in Constantinople, and narrowly escaped death at the hands of the brothers of Eudoxia. About this time (1153), a conspiracy against the emperor, in which Andronicus participated, was discovered, and he was thrown into prison. There he remained for about twelve years, during which time he made repeated but unsuccessful attempts to escape. At last, in 1165, he was successful; and, after passing through many dangers, reached the court of Jaroslav, grand duke of Russia, at Kiev. While under the protection of the grand duke, Andronicus brought about an alliance between him and the emperor Manuel, and so restored himself to the emperor's favor. With a Russian army he joined Manuel in the invasion of Hungary, and assisted at the siege of Semlin. After a successful campaign, they returned together to Constantinople; but a year after (1167) Andronicus refused to take the oath of allegiance to the prince of Hungary, whom Manuel desired to become his successor. He was removed from court, but received the province of Cilicia. Being still under the displeasure of the emperor, Andronicus fled to the court of Raymond, prince of Antioch. While residing here he captivated and seduced the beautiful daughter of the prince, Philippa, sister of the empress Maria. The anger of the emperor was again aroused by this dishonor, and Andronicus was compelled to fly. He took refuge with Amaury, king of Jerusalem, whose favor he gained, and who invested him with the town of Berytus, now Beirut. In Jerusalem he saw Theodora, the beautiful widow of the late king Baldwin, and niece of the emperor Manuel. Although Andronicus was at that time fifty-six years old, age had not diminished his charms, and Theodora became the next victim of his artful seduction. To avoid the vengeance of the emperor, she fled with him to the court of the sultan of Damascus, but not deeming themselves safe there, they continued their perilous journey through Persia and Turkestan, round the Caspian Sea and across Mount Caucasus, until at length they settled among the Turks on the borders of Trebizond. Into that province Andronicus, with a body of adventurers, made frequent and successful incursions. While he was absent upon one of them, his castle was surprised by the governor of Trebizond, and Theodora with her two children were captured and sent to Constantinople. To obtain their release Andronicus made abject submission to the emperor; and appearing in chains before him, implored pardon. This he obtained, and was allowed to retire with Theodora into banishment into the little town of Cœnoe, on the shores of the Black Sea. In 1180 the emperor Manuel died, and was succeeded by his son Alexis II., a youth of twelve or fourteen years, who was under the guardianship of the empress Maria. Her conduct excited popular indignation; and the consequent disorders, amounting almost to civil war, gave an opportunity to the

ambition of Andronicus. He left his retirement, secured the support of an army, and marched upon Constantinople. Alexis was compelled to acknowledge him as a colleague in the empire. The empress was put to death, and her son soon shared the same fate. His dead body is said to have been insulted by Andronicus, but the authorities for this and similar stories are in all probability prejudiced. Andronicus, now (1183) sole emperor, married Agnes, widow of Alexis II., a child eleven years of age. His short reign was characterized by strong and wise measures. He resolved to check many abuses, but above all things to limit the power of the nobles. The people who felt the severity of his laws, at the same time acknowledged their justice, and found themselves protected from the rapacity of their superiors. The aristocrats, however, were infuriated against him, and summoned to their aid William of Sicily. The prince landed in Epirus with a strong force and marched as far as Thessalonica, which he took and destroyed; but he was shortly afterward defeated, and compelled to return to Sicily. Andronicus seems then to have resolved to exterminate the aristocracy, and his plans were nearly crowned with success. But in 1185, during his absence from the capital, his lieutenant ordered the arrest and execution of Isaac Angelus, a descendant of the first Alexis. Isaac escaped, and took refuge in the church of St. Sophia. He appealed to the populace, and a tumult arose which spread rapidly over the whole city. When Andronicus arrived he found that his power was overthrown, and that Isaac had been proclaimed emperor. His offers of a general pardon, and even of abdication in favor of his son, were rejected; and after an unsuccessful attempt at escape, he was seized and dragged before the new emperor. Isaac delivered him over to his enemies, and for three days he was exposed to their fury and resentment. At last they hung him up by the feet between two pillars. His dying agonies were shortened by an Italian soldier, who mercifully plunged a sword into his body. He died on the 12th September 1185.

ANDRONICUS II. (PALÆOLOGUS), Emperor, was born 1260. He was the elder son of Michael Palæologus, whom he succeeded in 1283. During his reign the Turks under Osman conquered nearly the whole of Bithynia; and to resist them the emperor called in the aid of Roger de Flor, who commanded a body of adventurers. The Turks were defeated, but Roger was found to be nearly as formidable an enemy to the imperial power. He was assassinated in 1308. His adventurers declared war upon Andronicus, and after devastating Thrace and Macedonia, settled in the southern part of Greece. From 1320 onwards the emperor was engaged in war with his grandson, Andronicus, in whose favor he was compelled to abdicate, 1328. He retired to a convent, and died about 1334.

ANDRONICUS III., grandson of the preceding, was born about 1296. His conduct during youth was so violent, that his grandfather resolved to deprive him of his right to the crown. Andronicus rebelled, and in 1328 compelled his grandfather to abdicate in his favor. During his reign he was engaged in constant war, chiefly with the Turks, who greatly extended their conquests. He died in 1341.

ANDRONICUS OF CYRRHUS, a Greek astronomer, about B.C. 100, built at Athens an octagonal tower, with figures carved on each side, representing the eight principal winds. Abrazed Triton at the summit, with a rod in his hand, turned round by the wind, pointed to the quarter from which it blew. From this model is derived the custom of placing weathercocks on steeples. A considerable portion of this tower still exists.

ANDRONICUS OF RHODES, the eleventh scholar

of the Peripatetics, lived about B.C. 70. His chief work was the arrangement of the writings of Aristotle, the materials for which had been supplied to him by Tyrannion.

ANDROS, or ANDRO, the ancient *Andros*, an island of the Grecian Archipelago. It is nearly 25 miles long, and its greatest breadth is 10 miles. Its surface is for the most part mountainous, with many fruitful and well-watered valleys, which produce vines, grain, olives, pomegranates, lemons, figs, and oranges, and supply food for cattle, silk-worms, and bees. At Andros, the capital, a town on the east coast, containing about 5000 inhabitants, there are silk and carpet manufactures. The island is supposed to contain about 15,000 inhabitants, the bulk of whom belong to the Greek Church.

ANDUJAR, a town of Spain, in the province of Jaen, Andalusia, situated near the Guadalquivir. It is a dull, unhealthy place, possessing few buildings of any architectural beauty; but there is a road leading to an old bridge over the Guadalquivir which is lined with fine trees. Population, 14,096.

ANDUZE, a town of France, in the department of Gard, situate on the Gardon d'Anduze, about 6 miles S.W. of Alais. It possesses considerable manufactures of serges, stockings, hats, silk, and leather, and has 5303 inhabitants, many of whom are Protestants.

ANECDOTE, means originally something not published. It has two distinct significations. First, the primary one is something not published, in which sense it has been used to denote either secret histories,—*Procopius*, e.g., gives this as one of the titles of his secret history of Justinian's court,—or portions of ancient writers which have remained long in manuscript and are edited for the first time.

ANEL, DOMINQUE, an eminent French surgeon, born at Toulouse in 1679. He is celebrated for his successful treatment of aneurism and *fistula lachrymalis*, and was the inventor of the probe and syringe still known by his name. He died in 1730.

ANEMOMETER, or *wind-measurer*, a contrivance for indicating the rate and direction of the wind. Among meteorological phenomena, none deserve more attention than the elements of the wind; and none have received more. The error which, from the days of Hooke, in the middle of the 17th century, to within a comparatively recent period, misdirected the efforts of inventors, was the idea that the elements to be determined in the case of the wind are its direction and *pressure*, whereas practically they are its direction and *velocity*. If the currents of air were anything like uniform, it would be a comparatively simple matter to deduce the velocity from the pressure; but their variability is so very great, that the relations between the velocity and the pressure become unworkably complex.

The essentials of every anemometer are two: (1), a *wind-vane*, to show changes of direction; and (2), a *wind-gauge*, to show changes of velocity, or of force. There is also a distinction which we may have in every kind of meter. They may be either *non-recording*, as merely exhibiting the variations to the eye; or, *recording*, or marking them permanently on paper.

ANEMONE, a genus of *Ranunculaceæ*, of which the species are numerous and beautiful. The word anemone or wind-flower is common in the United States and the garden anemone is a favorite florist's flower.

ANEMONE, SEA. See ACTINOZOA, Vol. I., page 39.

ANEROID, the name given to a barometer invented in 1844 by M. Vidi, of Paris, by which the pressure of the air is measured without the use of liquid, as in ordinary instruments.

ANET, town of France, in the department of Eure-et-Loire. It contains the ruins of a magnificent castle,

built by Henry II. for Diana of Poitiers, and near it is the plain of Ivry, where Henry IV. defeated the armies of the League in 1590. It has 1,418 inhabitants, who carry on a small trade in corn, wood, and fodder.

ANEURISM, a cavity, which contains blood, either fluid or coagulated, and which communicates with an artery; the walls of the cavity are formed either of the dilated artery or of the tissues around the vessel. This affection, a malady of middle life and old age, may arise in consequence of injury or disease of the blood-vessels.

ANGARA, UPPER and LOWER, two rivers of Asiatic Russia, in the government of Irkutsk. The former rises in the mountains to the east of Lake Baikal, and falls into the head of the lake after a course of nearly 300 miles. The latter, which is sometimes called the Upper Tungonska, flows out of Lake Baikal, near its southern extremity, and passing the town of Irkutsk, falls into the Yenisei, after a course of about 1,100 miles. The scenery on its banks is frequently extremely beautiful.

ANGARIA, a sort of government postal system adopted by the Romans under the empire, borrowed from the ancient Persians, among whom, according to Xenophon, it was established by Cyrus. Couriers on horseback were posted at certain stages along the chief roads of the empire, for the transmission of royal despatches by night and day in all weathers. The supply and maintenance of horses were compulsory, which under the Romans was a heavy burden.

ANGEL, a *Messenger*, but in signification corresponds to the special theological sense which the latter word assumed among the Hellenistic Jews, by being adopted as the translation of the Hebrew *Mal'akh*. Thus both name and notion of angel go back to the Old Testament.

The Biblical doctrine of angels must be studied with the aid of the best books on Biblical theology (Schulz, Oehler, Ewald, Weiss, etc.), and of the commentaries on special passages. The literature of the subject, theological and theosophic, is immense.

ANGEL, a gold coin, first used in France in 1340, and introduced into England by Edward IV. in 1465. It varied in value between that period and the times of Charles I. from 6s. 8d. to 10s. The name was derived from the representation it bore of St. Michael and the dragon.

ANGEL-FISH, often called the Monk-fish (*Rhina Squatina*), is in structure nearly allied to the sharks, but resembles the skate in its general habit, flattened body, and wide pectoral fins. It is found in the North Atlantic, and is probably one of the most hideous inhabitants of the ocean.

ANGELICA, a genus of plants of the natural order of Umbelliferae. The name of Angelica is popularly given to a plant of an allied genus, the tender shoots of which are used in making certain kinds of aromatic sweetmeats.

ANGELO, MICHEL. See MICHEL ANGELO BUONAROTTI.

ANGELUS BELL, a bell rung at morning, noon and sunset to invite Catholics to repeat the "Ave Maria." It forms the subject of a famous picture by Millet, which has been exhibited in the United States, and many of the poets (notably Byron) have made it the theme of verse.

ANGELUS SILESII, a German philosophical poet, was born in 1624 at Breslau or Glatz, and died at Breslau in 1677. His family name was Johann Scheffler, but he is generally known under the assumed name which marks the country of his birth. Brought up a Protestant, and at first physician to the duke of Würtemberg, he embraced, in 1653, the Roman Catholic religion, and took orders as a priest. His peculiar religious faith is a

mystical pantheism founded on sentiment. The essence of God he held to be love. God and man are therefore essentially one. A selection of his hymns, which are very popular in Germany, was published in 1820 by Varnhagen Von Ense.

ANGERMANN, a river of Sweden, which rises among the mountains that separate Sweden from Norway, and flows in a southeasterly direction entering the Gulf of Bothnia near Hernösand, after a course of about 250 miles. It is navigable for upwards of 50 miles from the sea, and the scenery on its banks is sometimes very beautiful.

ANGERMÜNDE, a town of Prussia, capital of a circle of the same name in the province of Brandenburg, situated on Lake Münde, 43 miles from Berlin. It contains about 6,400 inhabitants, who are chiefly employed in the manufacture of woollen and linen goods.

ANGERS, an ancient city of France, capital of the department of Maine-et-Loire, and formerly of the old province of Anjou, situated on the Maine, about 161 miles S. W. of Paris. The chief manufactures at Angers are sail cloths, ropes, linen goods, hosiery, sugar, leather, wax, and oil; there is also a considerable trade in corn, wine, and fruits, and in the neighborhood there are extensive slate quarries, which give employment to about 3000 workmen. Pop. (1901), 82,966. It was captured by Odacer in 464 A.D., and by Clovis in 486; it suffered severely from the invasions of the Northmen in 845 and the succeeding years, and of the English in the 12th and 15th centuries; The Huguenots took it in 1585, and the Vendean royalists were repulsed near it in 1793.

ANGERSTEIN, JOHN JULIUS, an opulent London merchant, and a distinguished patron of the fine arts, was born at St. Petersburg in 1735, and settled in London about 1749. His collection of paintings, consisting of about forty of the most exquisite specimens of the art, purchased by the English Government, on his death in 1822, for £60,000, formed the nucleus of the National Gallery.

ANGHIARI, a small town of Italy, in the province of Arezzo. Population of the commune, 6900.

ANGILBERT, Str., the most distinguished poet of his age, was the secretary and friend of Charlemagne. After filling the highest offices under that monarch, and receiving the hand of his daughter Bertha in marriage, he retired in 790 to the monastery of Centule, or Saint Riquier, of which in 794 he was made abbot. He left this retreat from time to time when the king required his services, and in 800 assisted at Rome at his coronation. He died in 814. Angilbert was called by Charlemagne the *Homer* of his time.

ANGINA PECTORIS, a term applied to a violent paroxysm of painful sensations in the chest, arising for the most part in connection with some form of heart disease. An attack of angina pectoris usually comes on with a sudden seizure of pain, felt at first over the region of the heart, but radiating through the chest in various directions, and frequently extending down the left arm. A feeling of constriction and of suffocation accompanies the pain, although there is seldom actual difficulty in breathing. When the attack comes on, as it often does in the course of some bodily exertion, the sufferer is at once brought to rest, and during the continuance of the paroxysm experiences the most intense agony. The countenance becomes pale, the surface of the body cold, the pulse feeble, and death appears to be imminent, when suddenly the attack subsides, and complete relief is obtained. The duration of a paroxysm rarely exceeds two or three minutes, but it may last for a longer period. The attacks are apt to recur

on slight exertion, and even in aggravated cases without any such exciting cause. Occasionally the first seizure proves fatal; but more commonly death takes place as the result of repeated attacks. Angina pectoris is extremely rare under middle life, and is much more common in males than in females.

ANGLE, a term employed in different senses, the most common and simple use of it—to which all the rest may be referred, and by which they may be explained—being to indicate the inclination of two straight lines to each other. See **GEOMETRY** and **TRIGONOMETRY**.

ANGLER-FISH, sometimes called the **FISHING-FROG** (which is a palpable misnomer), and also known from its voracity and ugliness as the **SEA-DEVIL**, is found in the coast waters of the North Atlantic. It measures three feet or more in length and has an enormous head and wide mouth, furnished with sharp teeth.

ANGLES. According to the usual account, which rests on the authority of Bede, the Angles were one of three tribes and passed over from the Continent in the fifth and sixth centuries, and, taking possession of different parts of England, formed the main and dominant element in its subsequent population. The Saxons, he tells us, and he is followed by the authors of the Saxon chronicles, were situated in what is now Holstein; the Angles occupied the district to the north, probably extending across the peninsula, and beyond the Angles were the Jutes, in (approximately) the modern Jutland. Hypothetically they are identified with the *Angli* of Tacitus, who were seated on the Lower Elbe; and certainly they belonged to the Low German race.

ANGLESEA or **ANGLESEY**, an insular county of North Wales, separated from the mainland of England by the Menai Strait. The island contains 193,511 acres. The exports consist of barley, oats, cattle, sheep, and hogs; and a considerable trade is carried on in butter, cheese, hides, tallow, wax and honey. It contains valuable minerals, and furnishes copper, lead, silver, marble, asbestos, limestone, marl and coal. Anglesea was anciently famous as the seat of the Druidical pontiff, and a Druidical college; and a number of (so-called) Druidical remains—such as the cromlechs at Plas Newydd—are still to be seen. In 61 A.D. Suetonius Paulinus attacked the Druids in this their safest retreat, and they were utterly subdued by Agricola in 78. The number of inhabitants is 35,127.

ANGLESEA, ARTHUR ANNESLEY, EARL OF, lord privy seal in the reign of King Charles II., the son of Sir Francis Annesley, Lord Mount-Norris, and Viscount Valentia, in Ireland, was born at Dublin 10th July 1614. He was president of the council of state after the death of Cromwell, and was principally concerned in bringing about the Restoration. He succeeded to his father's titles in 1660, and in 1661 was enrolled in the English peerage as Lord Annesley of Newport-Pagnell, Bucks, and Earl of Anglesea. Annesley was a person of great abilities and of very extensive learning, and for some time held the office of Lord Privy Seal. He died in April, 1686.

ANGLESEY, HENRY WILLIAM PAGET, FIRST MARQUIS OF, one of the most distinguished British generals of the 19th century, was born on 17th May 1768. He was the eldest son of Henry, Lord Paget, first Earl of Uxbridge, of whose family of twelve sons and daughters he was the last survivor. Quitting the Oxford University in 1790, he entered parliament the same year as member for the Carnarvon group of boroughs, for which he sat six years. But to his high-spirited and impetuous nature the soldier's life was most attractive; and during the excitement which was occasioned by the outbreak of the wars of the French Revolution, Lord Paget raised on his father's estate the

regiment known at first as the Staffordshire Volunteers, and afterwards as the 80th Foot in the regular army. Of this regiment he was named lieutenant-colonel. Promoted colonel in 1796, he was transferred in April 1797 to the command of the 7th Light Dragoons, and then began to apply himself strenuously to the improvement of discipline, and the introduction of a new system of cavalry evolutions. In 1799 he took part in the campaign, brief and disastrous, to the Duke of York in Holland. Devoting himself through the following eight years, with zeal equal to his abilities, to the discharge of his regimental duties, and to the perfecting of the reforms which he had previously introduced, he attained the rank of major-general in April 1802, and that of lieutenant-general in April 1808. At the close of this year the great war with the French in the Peninsula began, and Lord Paget was sent, with two brigades of cavalry, to join the division of the army under Sir David Baird, who was then marching to join Sir John Moore in his advance on Salamanca. He especially distinguished himself by brilliant and successful encounters with the French at Sahagun, Mayorga, and Benevente. At the battle of Coruña, fought on the 16th January 1809, and mournfully memorable for the fall of the brave Sir John Moore, Lord Paget had the command of the reserve; and while the dying commander was being carried from the field, his lordship, by a swift, courageous movement, repulsed a superior force of the enemy, thus deciding the fate of the day and securing the safe embarkation of the British army. With this action his services in the Peninsular war terminated, and in the autumn he returned to England, where he applied himself to his parliamentary duties as member for Milbourne Port. In the spring of 1815 all Europe was startled by the news of the escape of Napoleon I. from his island prison, Elba, of his reappearance in France at the head of an army, and of his reassumption of the imperial dignity. Without delay the armies of the allies were sent again into the field, the English under the Duke of Wellington as commander-in-chief, and the English cavalry under the command of the Earl of Uxbridge. At the decisive battle of Waterloo (18th June), after twice leading the guards to the charge, he placed himself at the head of the heavy brigade, and, by a third rapid and terrific charge, completely overwhelmed the trusted French guards, led by Count D'Erlon, making 3000 prisoners, and killing most of the rest. In the confusion which followed, Napoleon, from a low rising ground, directed the fire of four guns, and by one of their discharges, almost the last shot that was fired, the earl was struck on the knee, and amputation of the limb was found to be necessary. Five days after the battle the services of the earl were rewarded by the dignity of Marquis of Anglesey, conferred on him by the Prince Regent; and he was soon after nominated Knight Grand Cross of the Bath. He was sent to Ireland as lord-lieutenant in 1826. He pleaded for Catholic emancipation in parliament, and on the formation of Earl Grey's administration, in November, 1830, he became viceroy of Ireland. To the Marquis of Anglesey Ireland is indebted for the Board of Education, the origination of which may perhaps be reckoned as the most memorable act of his viceroyalty. Seldom have bravery, gentleness, and generosity been combined in such noble proportions.

ANGLIA, EAST, a kingdom founded by the Angles (*g.v.*) in the sixth century in the eastern part of England in what now forms the present counties of Norfolk and Suffolk. It was conquered by the Danes in 878, and became part of the English kingdom in 921, under Edward, son and successor of Alfred.

ANGLICAN, pertaining to the Church of England and the other Episcopalian churches in communion

with it. The word is sometimes used especially of the High Church party.

ANGLING is the art of catching fish by rod, line, and hook, or by line and hook, the salient feature of the pursuit being the allurements of the prey by an attractive bait. The requisites for a successful angler are, knowledge of the haunts and habits of fish, dexterity in the use of tackle, and a patience much in excess of that required for most out-of-door amusements. The first qualification covers a wide field of study, involving, as it does, familiarity with the movements of fish at different seasons of the year, and in varying conditions of water; with the food peculiar to different species, and with the characteristics of the fishes angled for. Much of this may be learned from the voluminous works upon the subject, but personal observation in the essentials of the sport, which has been designated "the contemplative man's recreation," is absolutely necessary for mastership of an art which is no less difficult than delightful. In like manner, skill in the use of rod and line depends more upon actual experiments by the water side than acquisition of theories published by others.

The antiquity of angling is indicated in the well-known passage by the prophet Isaiah (xix. 8), variously translated in the past, but newly rendered in the revised version as, "The fishers also shalt lament; and all they that cast angle into the Nile shall mourn." Other Old Testament writers are also claimed as witnesses to the ancient practice of fishing with hook and line. That it was known to Greeks, Romans and Egyptians as a pastime may be gathered from inscriptions, coins, frescoes, and other relics of the remote past; and Homer and Plutarch wrote with great accuracy of detail, and some sympathy, upon fish and the methods in vogue in their days for catching them. A reference by Martial even suggests that fly-fishing, which is sometimes supposed to be a comparatively modern accomplishment, was known to the Romans in the second century.

Modern angling is pursued under vastly different conditions to those discussed by writers of the last century; and though all the rudimentary basis of the art remains what it has been for generations, altered circumstances have produced a new development. These arise from the growing facilities for traveling; the establishment of a cheap and extensive literature, periodical and permanent; the advance of science in the direction of fish culture and mechanical appliances; and the better condition of the people.

Fishing Tackle.—The soundest advice we can tender to the angler in the matter of fishing-tackle is to cumber himself with as little as possible, and to see that what he uses is good, but of the simplest kind. If one might form an opinion from the bulky illustrated catalogues circulated by the tackle-makers, there is no class of sportsmen so full of fancies and crotchets as anglers, but every experienced fisherman knows that a large proportion of the pretty patented novelties are made to sell rather than for practical use. Much of the pleasure of angling is lost when the angler hampers himself with too much baggage. He requires a rod, line, winch, bait and receptacle for his fish, and should be able to carry all and indulge in his sport without fatigue from the burden strapped across his shoulders and independent of assistance. As a rule it is cheaper to buy than to make fishing-tackle, but it is most useful in cases of emergencies to know how to whip a hook to gut, how to repair a broken rod, how to replace a lost ring, or how to tie an artificial fly. Having discovered the description of tackle that suits him and the branch of fishing in which he engages, the angler should stick to it and not be tempted into acquisition of new-

fangled gear merely because it is novel. All tackle should be carefully tested before use and be put away clean and dry after use. The habit of so dealing with it at the end of the day's sport should be a primary acquirement from considerations alike of economy, efficiency and comfort.

Rods depend entirely upon the branch of angling to be followed. The aim of every rod-maker should be, when suppleness is a necessity, to produce an implement as closely as possible resembling the natural growth like the bamboo, or the peeled wand used by boys in their novitiate, and in rods where stiffness is essential, a regularity of strength that shall produce a free balance. The heavy, clumsy fishing-poles of our grandfathers are quite out of fashion, and the adoption of cane as a material for rods has assisted materially in the revolution which was begun in the United States. The light and strong rod made of sections of cane joined with perfect accuracy, and known as the split-cane rod, is the most serviceable in the world.

For fly-fishing a spliced rod is preferred by experienced anglers, especially for salmon, but the ferrule has become almost universal for general angling. The old-fashioned practice of hollowing the butt for receiving the spare top is not to be recommended, since it weakens the rod at a critical part and destroys the balance. The main point in selecting a rod is to choose one that fits the hand, and to pay for utility and not ornament. The ferrules should be stopped when the rod is idle and the bag in which the joints are kept should be suspended from a loop which prevents the warping of the pieces. The trouble arising from the sticking together of the ferruled joints may be avoided by rubbing the brazen parts with common soap. Standing rings are now preferred, and the ring at the end of the top joint is best with a revolving center.

Lines and winches are very important items of outfit and they are made in inconceivable variety. The former are of plaited silk, cotton, hair and silk, hair and gut, and horsehair. The plaited lines are either dressed or undressed to make them waterproof and to prevent kinking, but if dressed the process should be of the best, otherwise the cracking of the dressing will be a constant source of irritation and mischief, and the work will have to be continually repeated. Any good angling book will give receipts for line-dressing, but amateur dressing seldom answers. Plaited silk lines, tapered down to meet and correspond with the finest gut casts and well-dressed, are much used. They are stronger, susceptible of better casting of silk and hair lines which they have supplanted, and do not retain the water. In many districts, however, the more primitive lines are still used. Lines should be unwound from the winch at the earliest moment after use and thoroughly dried before winding up, and at the river the first thing that should be done after the line has been drawn through the winch previous to the putting on of the gut cast, is to subject a few yards to a trial of strength so that no weak spot may be left to lead perhaps to the loss of both tackle and fish. Winches are of nickel, silver, bronze, vulcanite, brass and wood, the cheapest being the last two. The most serviceable winches are those with least mechanism. For the higher exercises of angling nothing can beat a strongly-made bronze winch with a respectable amount of check. Foot-lines are the lengths of finer material attached to the line for the more complete deception of fishes. They are either of gut or single horse hair, and are essential to fly-fishing and other forms of angling. When used by fly-fishers this foot-line is sometimes called a collar and sometimes a cast, and is generally made of gut. Occasionally, and in special districts, horsehair casts, tapering from a

twist of three to a single strand, keep their ground, it being claimed for them that they have an elastic spring and a freedom from glitter impossible with gut. Reliable hair casts are, however, difficult to procure, and when used are invariably home-made by some local specialist. The gut must be round, even and transparent, and should be well moistened and straightened when wanted. Three yards is the orthodox length for the cast, but less will suffice for float fishing.

Hooks are now made with eyes both upturned and turned down. In the nomenclature and numbering of hooks there is great confusion. Although the Japanese artificial flies are made with barbless hooks, and American anglers use a hook which is called barbless, it is impossible in this respect to improve upon the familiar plan. In very olden times hooks were clumsy and ill-contrived but the necessity of a barb was well understood, and in the South Sea Islands the native hooks, with their rude shanks of mother-of-pearl, have a sharp curved fork of bone answering the purpose of a barb.

Miscellaneous gear for angling comprises a basket or bag, without which the equipment would lack its most cherished object. Whether a basket or creel is better than a bag (waterproof or the reverse) is entirely a matter of taste. The landing net is for securing a fish which is played out but yet too heavy to be lifted from the water bodily by the line and the gaff is for salmon and pike, too large for treatment with a landing net, which must be small to be portable and capable of being hitched to the strap of the basket and carried behind the shoulders ready for use.

Fly-fishing is the highest form of angling, and is applied to the most valuable of our fresh water fish. Many sportsmen consider any other kind of fishing as unworthy of consideration, forgetting that it is the lower branches which gives the greatest happiness to the greatest number of anglers. Fly-fishing for trout is a delicate operation. Until comparatively recent years the fly-fisher attached three or more flies to his cast, threw them lightly up or down stream as his experience prompted him, and allowed them to float naturally with the current. There are amongst trout fishers an up-stream faction and a down-stream faction, the former using a short line and casting up the stream. By this method the angler is always behind the fish, minimises the risks of scaring, and is able to strike the hook right into and not out of its mouth. This is doubtless the most scientific style when conditions are favorable. To allow the flies to drift down below is, however, easier, and in very rapid waters, indeed, the only way in which fishing can be carried on. The flies used are made in imitation of the *Ephemera* and other water insects, hackled only or so little dressed as to be termed spiders. These have their distinct uses on different streams. In fly-fishing the golden rule is to keep as far as possible away from the water and out of sight of the fish; to make the line and fly drop lightly and straight, to strike firmly but gently, to keep the hooked fish well in hand and get it down stream without delay. Eyed hooks are recommended because they may be easily carried in a small box, because there is no risk from the fraying of the gut at the head of the fly, and because the angler is always sure that the gut nearest the hook will be of the size required. Spinning and live baiting are processes in salmon, trout, perch, and pike-fishing. Spinning may be accomplished with either artificial or natural bait, the object being to present to the predatory fish angled for, the colorable imitation of one of the smaller species swimming away from it. It ranks next to fly-fishing as a sportsmanlike branch of angling. The spinning baits revolve upon a swivel, and are best worked against stream. The spoon bait

which is often colored red inside, spins by reason of its convex shape and is a most killing bait for all fish of predaceous habits. The best foot-line for spinning baits is of twisted or single salmon gut, with at least two swivels; and when leads are necessary, they should be colored green. Many anglers fail in spinning through not sinking the bait deep enough, and through spinning too rapidly. The fish to be caught often lie low, and the angler must operate as he can upon their level. The larger baits will serve for both salmon and pike; the smaller artificial minnows for trout and perch. Live baits, in the parlance of anglers are small fish, shrimps or frogs. They must be vigorous and should be used with snap tackle, that is to say, with hooks so arranged that they enter the mouth of the fish and may be extracted to enable undersized or ill-conditioned specimens to be returned to the water. They are used with float suspended at varying depths and traveling with the stream or upon the paternoster or length of stout gut with single hooks attached to short lengths of gimp or gut. These are fastened to the foot-lines by loops and the hooks being baited, that apparatus sinks to the bottom by means of a weight at the end. The use of the gorge hook for live baiting and trolling has long been discredited as unsportsmanlike, but it is often used. It is absorbed into the gullet, the two hooks finding lodgment in a vital part.

Bottom fishing is a term which is intended to express the art of angling for fish feeding on the beds of streams, and though it is not precisely accurate, we may for expediency here adopt it. The rod for bottom fishing is stiffer than that required for the fly-fishing and the recreation is often sedentary. Angling is largely practiced in the United States, Sweden, Norway and Iceland. The trout and grayling streams of Germany and Austria are famous for sport. In India the mahseer is the object of the angler's desire; in New Zealand and Tasmania the successful acclimatization of trout has introduced a new recreation for colonial anglers.

ANGLOMANIA, a weak imitation of English customs, fashions and society manners, which at different times has afflicted France and Germany, and is unfortunately not unknown in the United States.

ANGLO-SAXON LITERATURE. See ENGLISH LITERATURE.

ANGLO-SAXONS. See ENGLAND.

ANGOLA, a name that is employed to designate at least three different, although partly coincident, portions of the west coast of Africa. The Portuguese consider that the entire country lying between the Zaire or Congo, and stretching for a considerable but somewhat indefinite distance into the interior, ought to be called Angola; the name is by most British geographers and travelers applied to that part of the preceding territory which lies between 8° 20' and 9° 30' south, and which nearly corresponds to the Portuguese sub-government of Angola.

ANGORA, or ENGURI, a city of Turkey in Asia, capital of the vilayet of the same name, about 200 miles E.S.E. of Constantinople. Angora has long been celebrated for its goats, whose soft silky hair, about 8 inches long, forms the chief article of export from the town.

The population is estimated at from 20,000 to 30,000. pop. of the province, about 900,000.

ANGORNO, or NGORNU, a town of Bornu, in Central Africa, near the south-west shore of Lake Chad. It is said to have a population of 30,000, which is much increased during the markets, when a large traffic is carried on in cotton, amber, metals, corals, and slaves.

ANGOSTURA, also called CIUDAD BOILVAR, and SAN TOMAS DE LA NUEVA GUAYANA, a town of Vene-

zuela, capital of the province of Guyana, situated on the right bank of the Orinoco, about 240 miles from its mouth. The Orinoco is navigable for vessels of 300 tons, and a considerable trade is carried on in cocoa, sugar, cotton, jerked meat, and hides, as well as in the bark that takes its name from the city. Population, 10,861.

ANGOSTURA BARK, the aromatic bitter bark of the *Galipea cusparia*, a native of Venezuela. The bark yields a valuable tonic, and under the name of Angostura bitters a decoction containing its volatile oil is used.

ANGOULEME, a city of France, capital of the department of Charente, and formerly of the province of Angoumois, situated on the left bank of the Charente, upon an elevated plateau, 221 feet above the river. Angoulême is an important manufacturing city; its paper-mills produce large quantities of paper that is highly esteemed throughout France; and there are also distilleries, potteries, a cannon factory, a powder mill, linen and serge factories, as well as a considerable trade in grain, fruit, and salt. Population, (1901), 36,955.

ANGOULEME, CHARLES DE VALOIS, DUKE OF, the natural son of Charles IX. of France and Marie Touchet, was born 28th April 1573, at the castle of Fayet in Dauphiné. His father, dying in the following year, commended him to the care and favor of his brother and successor, Henri III., who faithfully fulfilled the charge. His mother married François de Balzac, marquis d'Entragues, and one of her daughters, Henrietta, marchioness of Verneuil, afterwards became the mistress of Henry IV. Charles of Valois was carefully educated, and was destined for the order of Malta. At the early age of sixteen he attained one of the highest dignities of the order, being made grand prior of France. Shortly after he came into possession of large estates left by Catherine de Medicis, from one of which he took his title of count of Auvergne. In 1591 he obtained a dispensation from the vows of the order of Malta, and married Charlotte, daughter of Henri, marshal d'Amville, afterwards duke of Montmorenci. In 1589 Henri III. was assassinated, but on his deathbed he commended Charles to the good will of his successor Henri IV. By that monarch he was made colonel of horse, and in that capacity served in the campaigns during the early part of the reign. But the connection between the king and the marchioness of Verneuil appears to have been very displeasing to Auvergne, and in 1601 he engaged in the conspiracy formed by the dukes of Savoy, Biron, and Bouillon, one of the objects of which was to force Henri to repudiate his wife and marry the marchioness. The conspiracy was discovered; Biron and Auvergne were arrested, and Biron was executed. Auvergne after a few months' imprisonment was released, chiefly through the influence of his half-sister, his aunt, the duchess d'Angoulême, and his father-in-law. He then entered into fresh intrigues with the court of Spain, acting in concert with the marchioness of Verneuil and her father d'Entragues. In 1604 d'Entragues and he were arrested and condemned to death; at the same time the marchioness was condemned to perpetual imprisonment in a convent. She easily obtained pardon, and the sentence of death against the other two was commuted into perpetual imprisonment. Auvergne remained in the Bastille eleven years, from 1605 to 1616. In 1606 a decree of Parliament, obtained by Marguerite de Valois, deprived him of nearly all of his possessions, including Auvergne, though he still retained the title. In 1616 he was released, was restored to his rank of colonel-general of horse, and despatched against one of the disaffected nobles, the duke of Longueville, who had taken Peronne. Next

year he commanded the forces collected in the Isle de France, and obtained some successes. In 1619, he received a bequest, ratified in 1620 by royal grant, the duchy of Angoulême. Soon after he was engaged on an important embassy to Germany, the result of which was the treaty of Ulm, signed July, 1620. In 1627, he commanded the large forces assembled at the siege of La Rochelle; and some years after, in 1635, during the Thirty Years' War, he was general of the French army in Lorraine. In 1636, he was made lieutenant-general of the army. He appears to have retired from public life shortly after the death of Richelieu in 1643. His first wife died in 1636, and in 1644 he married Françoise de Nargonne, daughter of Charles, baron of Mareuil. She had no children and survived her husband many years. Angoulême died in 1650, in his seventy-sixth year.

ANGOUMOIS, an old province of France, nearly corresponding to the department of Charente. Its capital was Angoulême.

ANGRA, a city on the south coast of Terceira, one of the Azores, the capital of the island and one of the three civil districts into which the Azores are divided, as well as the residence of the military governor of the whole group, and of the Roman Catholic bishops. Population, (1900), 10,843.

ANGRA-PEQUENA, a bay on the southwest coast of Africa, which, with the adjoining country, was taken possession of by Germany in 1884, the acquisition giving rise to much jealousy on the part of England.

ANGRI, a town of Italy, in the province of Salerno, situated 11½ miles northwest of the town of Salerno, in a country which produces large quantities of grapes, cotton and tobacco. Narses defeated Teias, the last king of the Goths, not far from Angri in 553 A. D. Population, 10,332.

ANGSTROM, ANDERS JONAS, born in Sweden, August 13, 1814; died June 21, 1874. He was for many years connected with the University of Upsala, and he wrote extensively on heat, magnetism, and optics.

ANGUIER, FRANCOIS (born 1604, died 1669), and MICHAEL (born 1612, died 1686), two brothers, natives of Normandy, were distinguished sculptors in the time of Louis XIV. A marble group of the *Nativity* in the church of Val de Grace, was reckoned his masterpiece.

ANGUILLA, or SNAKE ISLAND, a small British West Indian island, one of the Lesser Antilles, situated eight miles north of the island of St. Martin.

ANGUSSOLA, ANGOSCIOLA, SOPHONISBA, one of the best portrait painters of the latter half of the sixteenth century, was born at Cremona in 1533, and died at Genoa in 1620.

ANHALT, a duchy of Germany, comprising an area of about 896 square miles. The chief manufactures of Anhalt are linen, cotton, and woolen goods, metallic and earthen wares, beer, brandy, and sugar; but the principal export trade is in the raw products. Internally, Anhalt is governed by a constitutional and hereditary monarchy, the legislative body being a diet of thirty-six members, of whom ten represent the nobility; fourteen, the principal towns; ten, the rural districts; and two are nominated by the duke, who has the entire executive power in his own hands; while, as a member of the German empire, the duchy has one vote in the Bundesrath, or Federal Council, and two in the Reichstag. Anhalt contained 316,027 inhabitants in 1901, most of whom are Protestants. Its capital is Dessau, and the other chief towns are Bernburg, Köthen, and Zerbst. Railways connect these towns with one another, and also with Berlin and the principal cities of Germany. Leopold I., of Anhalt Dessau, was one of the most distinguished soldiers of his time.

ANICHINI, LUIGI, an engraver of seals and medals, a native of Ferrara, lived at Venice about 1550. Michel Angelo pronounced his "Interview of Alexander the Great with the high priest at Jerusalem," "the perfection of the art." His medals of Henry II. of France and Pope Paul III. are greatly valued.

ANIELLO, TOMMASO. See MASANIELLO.

ANILINE, or PHENYLAMINE, is one of the very numerous products of the distillation of coal tar. The substance has been known to chemists since the year 1826, when M. Unverdorben, by the destructive distillation of indigo, produced a liquid of an oily consistence, which he termed *crystalline*. In the year 1835, Runge, a German chemist, isolated from the oil of coal tar a substance which, having the property of producing a beautiful blue color on treatment with chloride of lime, he named *kyanol*. In 1840, another investigator showed that by treating indigo with caustic potash it yields an oil, and he gave to his product the name *Aniline*, from the specific name of one of the indigo yielding plants, *Indigofera anil*. About the same time it was discovered that on treating nitrobenzol with a reducing agent, an organic base is formed, to which the observer of this reaction gave the name *benzidam*. Professor Hofmann, while a student in the laboratory of Baron Liebig, investigated these variously prepared substances, and found them to be identical in composition and action, and thenceforth they took their place as one body, under the name *Aniline* or *Phenylamine*. Pure aniline is a basic substance of an oily consistence, colorless, boiling at a temperature of 182°C. Dropped on paper aniline produces a greasy stain, which, owing to its volatilising at an ordinary atmospheric temperature, quickly disappears. On exposure to air it absorbs oxygen rapidly, and becomes a deep brown color; and it ignites readily, burning with a large smoky flame. It is possessed of a somewhat pleasant vinous odor, and a burning aromatic taste. It is a highly acrid poison, and Dr. Letheby has pointed out that the poisonous action of nitrobenzol is due to a change of that substance into aniline taking place within the stomach.

At the present time every color, and all tints and shades of colors, are produced from aniline; and, while the processes employed and the combinations formed are very numerous, the names under which the dye-stuffs are sold must be said to be endless.

One of the products of aniline manufacture is antipyrine, a valuable medicine for reducing fevers and exercising a depressing influence on the circulation, but, in the hands of unskilled persons, a dangerous remedy.

The greater proportion of aniline dyes manufactured are now produced directly or indirectly from another basic body, termed rosaniline. About the time of the French-Austrian war in 1859, a second coal-tar dye was introduced into commerce, which became popularly known as aniline red or Magenta, from the battle fought at the period of its introduction.

Aniline colors are employed in the industrial arts for numerous other purposes besides their great use as dyeing materials. Violet ink and other fancy colored inks are prepared from them. They are used by paper manufacturers for tinting pulps, and for the superficial staining of finished paper. They are likewise used by paper stainers in the printing of wall papers, in the preparation of lithographic inks, and to some extent for water colors. They are largely employed as coloring materials in perfumery, fancy soaps, and cosmetics, besides having many other minor applications.

ANIMALS, CLASSIFICATION OF. The object of classification is to bring together those things which are like, and to separate those which are unlike. Each science has its classification of the objects with which

it deals, the kinds of likeness and unlikeness according to which these objects are grouped varying in relation to the special qualities or properties of matter with which the science is concerned. Thus, the physicist classifies bodies according to their mechanical, electrical, thermic, or other physical properties; the chemist, regards their composition; while the zoologist and the botanist group them according to their likeness and unlikeness of structure, function, and distribution.

As soon as the labors of anatomists had extended over a sufficiently great variety of animals, it was found that they could be grouped into separate assemblages, the members of each of which, while varying more or less in minor respects, had certain structural features in common, and these common morphological characters became the definition of the group thus formed. The smallest group thus constituted is a MORPHOLOGICAL SPECIES. A certain number of species having characters in common, by which they resemble one another and differ from all other species, constitute a GENUS; a group of genera, similarly associated, constitutes a FAMILY; a group of families, an ORDER; a group of orders, a CLASS; a group of classes, a SUBKINGDOM; while the latter, agreeing with one another only in the characters in which all animals agree, and in which they differ from all plants, make up the ANIMAL KINGDOM.

The formation of a morphological classification is therefore a logical process, the purpose of which is to throw the facts of structure into the smallest possible number of general propositions, which propositions constitute the definitions of the respective groups. A perfect classification will fulfil this end, and, in order to form it, two conditions are necessary: Firstly, we must have a full knowledge of the adult structure of every animal, recent and extinct; secondly, we must know all the modifications of structure through which it has passed, in order to attain the adult condition, or in other words, the mode of development of the animal. For it is the sum of all the structural conditions of an animal which constitutes the totality of its structure; and if two animals, similar in their adult state, were unlike in their development, it is clear that the latter circumstance would have been taken into account in determining their position in a classification.

Linnæus, living at a time when neither comparative anatomy nor embryology can be said to have existed, based his classification of animals upon such broad resemblances of adult structure and habit as his remarkable sagacity and wide knowledge enabled him to detect. Cuvier and his school devoted themselves to the working out of adult structure, and the *Leçons d'Anatomie Comparee* and the *Règne Animal* are wonderful embodiments of the results of such investigations. But the Cuvierian system ignores development; and it was reserved for Von Baer to show the importance of developmental studies, and to inaugurate the marvellous series of researches which, in the course of the last fifty years, have made us acquainted with the manner of development of every important group of animals. The splendid researches of Cuvier gave birth to scientific palæontology, and demonstrated that, in some cases, at any rate, extinct forms of life present characters intermediate between those of groups which are at present widely different. The investigations of Agassiz upon fossil fishes tended in the same direction, and further showed that the older forms preserve, as permanent features, structural characters which are embryonic and transitory in their living congeners. Moreover, Darwin, Owen, and Wallace proved that, in any great area of geographical distribution, the later tertiary extinct forms are clearly related to those which now exist in the area. As Taxonomic investigations

increased in accuracy, and in extent, the careful examination of large suites of specimens revealed an unexpected amount of variability in species; and Darwin's investigation of the phenomena presented by animals under domestication proved that forms, morphologically as distinct as admitted natural genera, could be produced by selective breeding from a common stock.

Upon the foundation thus furnished, the doctrine of Evolution, first scientifically formulated by Lamarck, has been solidly built up by Darwin; and is now, with various modifications and qualifications, widely accepted. But the acceptance of this doctrine introduced a new element into Taxonomy. If all existing animals are the last terms of a long series of developmental stages, represented by the animals of earlier ages of the earth's history, the starting point of which has been a primordial form of the extreme simplicity consistent with animal life, then every animal has an "ancestral" as well as what might be termed a "personal" embryology; and the same considerations which oblige the Taxonomist to take account of the latter phenomena, compel his attention to the former stages of development. Two animals belong to the same group, when they are similar in structure, personal development, and ancestral development, and not otherwise. Hence it follows that a perfect and final zoological classification cannot be made until we know all that is important concerning—1, the adult structure; 2, the personal development; and 3, the ancestral development of animals. It is hardly necessary to observe that our present knowledge, as regards even the first and second heads, is very imperfect, while, as respects the third, it is utterly fragmentary.

The only germs of animals of which we possess a satisfactory, though still not quite complete, ancestral history, is the genus *Equus*, the development of which in the course of the Tertiary epoch from an Anchiitherioid ancestor, through the form of *Hipparion*, appears to admit of no doubt. And all the facts of geology and palæontology not only tend to show that the knowledge of ancestral development is likely long to remain fragmentary, but lead us to doubt, whether even such fragments as may be vouchsafed to us by the extension of geological inquiry will ever be sufficiently old, in relation to the whole duration of life on the earth, to give us positive evidence of the nature of the earliest forms of animals.

While holding the doctrine of evolution to its fullest extent, and having no doubt that Taxonomy ought to be the expression of ancestral development, or phylogeny, as well as embryogeny and adult structure, and while conceiving that the attempts at founding a scientific phylogeny, which have been made by Haeckel and others, are of much interest and importance as guides to and suggestors of investigation, the present writer looks upon all such attempts as provisional hypothesis; and he conceives that, at any rate for the present, it is a mistake to introduce considerations of this purely hypothetical kind into classification, which should be based on verifiable data.

In the case of an existing animal, it is possible to determine its adult structure and its development, and therefore to assign its place relatively to other animals, the structure and development of which are also known; and, in the case of an extinct animal, it is possible to ascertain certain facts of its structure, and sometimes certain facts of its development, which will justify a more or less positive assignment of its place relatively to existing animals. So far, Taxonomy is objective, capable of proof and disproof, and it should leave speculation aside, until speculation has converted itself into demonstration.

In the present rapidly shifting condition of our knowledge of the facts of animal structure and development, however, it is no easy matter to group these facts into general propositions which shall express neither more nor less than is contained in the facts.

In certain of the lower animals, the substance of the body is not differentiated into histogenetic elements; that is, into cells which, by their metamorphoses, give rise to tissues. In all other animals, on the other hand, the protoplasmic mass, which constitutes the primitive body, is converted into a multitude of cells, which become metamorphosed into the tissues of the body.

ANIMALCULE, a term which, though etymologically applicable to any very small animal, is limited in ordinary language to those which are microscopical. Animalcules exist in prodigious numbers, myriads of them being found in a single drop of water. The luminosity of the sea is due to the presence of animalculæ.

ANIMAL WORSHIP, a stage in religious evolution, characteristic of the less cultured races. Thus many tribes look upon certain animals as their totem or fetish, and consider them as sacred. With the ancient Egyptians the cat was sacred and cat-mummies have been found in Egyptian tombs. The pious Hindu looks with reverence upon the cow, and the worship of the serpent is perhaps more wide-spread than that of any other creature. The superstition underlying this is doubtless based on the theory of the transmigration of souls from men to animals.

ANIME, a resinous exudation from the *courbaril* tree, which grows in the West Indies and in South America. When imported in the natural state it is infested with vast numbers of insects, and hence the name. It is of a pale brown color, transparent, brittle, and in consequence of its agreeable odor is much used for fumigation and in perfumery. Its specific gravity varies from 1.028 to 1.054. It melts readily over the fire, and softens even with the heat of the mouth, but is insoluble in water. It is dissolved by alcohol, but not completely, unless the spirit be boiling. It is allied to copal in its nature and appearance, and is much used by varnish-makers.

ANIMISM, a term formally employed in Biology to denote the theory of which Stahl is the chief expositor; the theory of the soul (*anima*) as the vital principle, cause of the normal phenomena of life, or of the abnormal phenomena of disease. It is now current in the wider anthropological sense given to it by Dr. E. B. Tylor, *Primitive Culture*, as including the *general doctrine of souls and other spiritual beings*. This application is not only appropriate, but is even rendered indispensable by the absence of any other suitable word.

An animistic philosophy, explaining the more strange or striking phenomena of nature by the hypothesis of spiritual life, is universally prevalent among savage races; and unless the wide-spread animistic beliefs of savages are to be regarded as but degenerate or corrupted relics of those possessed by more cultured peoples,—a theory which can scarcely be held to account for the essential and native appropriateness of animism as it flourishes among races of low culture, and its less appropriate and apparently derivative character as it survives in higher civilisations,—there seems tenable ground for the inference, that an animistic philosophy must have been that which was earliest developed among the prehistoric societies of mankind. In accordance with this view, animism may be described as the distinctive philosophy of primitive culture. It is manifestly the outcome and development of that earliest analogical reasoning, which concludes external objects to be animated with a life essentially similar to our own; it is the expression and application of our

first general theory of natural causes,—a theory rude and inadequate, yet marvellously self-consistent and serviceable: and its history appears primarily to be that of a dominant and pervading philosophy, applied to explain all the phenomena of nature and life, save only those ordinary sequences which the uncivilised man regards as needing no explanation; afterwards, in the progress of culture, that of a system of thought always more or less modified and restricted by the increase of positive knowledge, and surviving only in greatly refined or greatly enfeebled forms, or only reviving at intervals of time.

Of the origin of animism perhaps no perfect account has yet been given. It can hardly be said to be obvious why, in uncultured races or individuals, there should arise that invariable tendency to represent natural forces as conscious and anthropomorphic. There is reason to believe, however, that the type of all the forms in which the tendency manifests itself, is to be discovered in the conception of the human soul. Evidently the notion of an animating, separable, and surviving soul commends itself as the ready explanation of many familiar phenomena, and the appropriate instrument of a philosophy which ascribes animation to nature at large; so that thus, according to the account given by Dr. Tylor, primitive animism may be considered to have arisen simply from the evidence of men's senses, interpreted by the crude and childlike science of the prehistoric world. From the sight of life and death it was, he conceives, naturally inferred that every man has a life, or vital principle, the departure of which from his body causes death,—this idea being confirmed by apparent temporary departures, such as swoons and sleep. From the appearance of men seen in dreams and visions, it was not less cogently argued that every man has also a phantom likeness of his body, separable from it so as to appear to others at any distance, and continuing to exist and appear after the bodily death of its proper owner. Accordingly, the definition of the soul in primitive religion would, as in the lower existing religions it actually does, combine these leading qualities in the conception of an "apparitional soul," which is a thin, unsubstantial, human image, the cause of life and thought in the individual it animates, capable of quitting his body for a time or altogether, and so leaving himself insensible or dead, and when thus absent from the body appearing to other persons asleep or awake. From this conception, then, animism may reasonably be supposed to have had its origin, especially as other animistic doctrines exhibit such a distinct affinity and relationship to this of the apparitional soul, as almost amounts to a proof of direct derivation from it. The hypothesis being correct, it would, for instance, follow that the lower animals ought to be considered as having souls similar to human souls, inasmuch as they have life, and their phantoms are likewise seen.

The final decay of many forms of animistic belief, much more readily than the process of their development, admits of being traced with the aid of historical evidence. Indeed, the history of each of the sciences is a record of the progressive substitution of matter for spirit and law for spontaneity; and we can still witness the process of decay in various stages; for while certain sciences—like astronomy, since the time when Kepler imagined minds in the planets—have wholly exterminated the animism within their borders, there are others that have scarcely yet advanced so far—biology, for example, which is still familiar with "vital force" and final causes. Nor is the process commonly a rapid one: in many cases, as a world of illustration has been adduced to prove, a declining spiritual conception may persist for a length of time, refined and modified into a "principle"

or "essence," whose action, though still automatic like a spirit's, is also regular like that of a natural law. Among all civilised races, however, animism has long ceased to be known as the universal philosophy or explanation of nature, and its remaining manifestations are in a great measure reduced to a secondary or rudimentary form. Thus animism survives in the imperfect theories of childhood; it survives also, as we have seen, in the superstitions of the uneducated; and as, in primitive societies, language and imagination fostered the development of spiritual myth, so animism, embodied in metaphor, remains in later civilisations as an important element, if not in truth the very substance of imaginative literature.

Reviewing the conclusions countenanced by what evidence we possess touching the nature and history of the doctrine of spiritual beings, we find that while it is possible, and even necessary, to regard animism as a system of primitive philosophy extending through various forms into the higher civilisations, yet this view being for the most part unsupported by direct historical evidence, and depending largely on the inference of a close analogy between primitive and savage thought, is in great measure confessedly theoretical, leaving much room for dispute, both as to the extent to which animistic beliefs have been transmitted and modified by a regular, continuous, and uninterrupted process, and as to the conditions which, in special instances, have led to their formation and development, or disappearance and decay. A theory that represents, not only the extravagances of mythology and superstition, but indeed all that we call spiritual, nay, all that we name divine, as but the fruit of a natural anthropomorphic tendency, much more appropriate to savage than to civilised life, is, it is manifest, in thorough inconsistency with many widely accepted doctrines of philosophy and theology. Regarding the importance of the inquiry there is, however, no dispute. Spiritual philosophy has influenced every province of human thought; and the history of animism, once clearly traced, would record the development, not of religion only, but of philosophy, science, and literature.

ANIMUCCIA, GIOVANNI, musical composer, was born at Florence in the fifteenth century and died in 1571. At the request of St. Filippo Neri he composed a number of *Laudi*, or hymns of praise, to be sung after sermon, which are noteworthy as furnishing the rudimentary form out of which the Oratorio was developed.

ANIO, or **ANIEN**, the modern *Teverone*, a river of Italy which rises in the Apennines, and, flowing first N.W. and then S.W., joins the Tiber a little above Rome. See **AQUEDUCT** and **TIVOLI**.

ANISE, *Pimpinella Anisum*, is an umbelliferous plant found in Egypt and the Levant, and cultivated on the Continent of Europe. It is used medicinally as an agreeable aromatic. The official part of the plant is the fruit, which consists of two united carpels, called a cremocarp. It is known by the name of aniseed, and has a strong aromatic taste and a powerful odor. By distillation the fruit yields a volatile, oily matter known as oil of anise. It is used as a carminative, and is also employed in the manufacture of liqueurs.

ANJÁR, a fortified town of Hindustán, and the capital of a district of the same name in the native state of Cutch.

ANJENGO, once a British factory and fortress, now a small sea-port town of India, in Travancore, nearly encircled by a deep and broad river, at the mouth of which it is situated.

ANJER, a sea-port town of the Dutch East Indian island of Java, situated on the Strait of Sunda, 18 miles W. of Batavia.

ANJOU, one of the thirty-six ancient provinces of France, approximately equivalent to the modern department of Maine and Loire. It was, as Mr. Freeman has remarked, altogether lacking in geographical individuality, and owed its somewhat prominent position in history to the character and fortune of its counts and dukes. In 1328 the son of Charles of Valois became king of France, as Philip VI., and united the duchy of Anjou to the crown. King John in 1356 bestowed it on his son Louis. The Anjou line ended in the unfortunate René (noticed below), who was deprived of his duchy by Louis XI. of France, or, more strictly, in his brother Charles, who died in 1481. Meanwhile old René's daughter Margaret, who was made of sterner stuff than her father, was battling with more than a woman's valor for the rights of her son in England. From this time onward the title of duke of Anjou has been borne, without implying any territorial sovereignty, by Charles VIII. of France, by each of the four sons of Henry II., by the second son of Henry IV., by the two sons of Louis XIV., by his grandson (Philip V. of Spain), and by his great-grandson (Louis XV.) Charles, a nephew of Charles of Naples, obtained the throne of Hungary in 1308, and was succeeded by his son Louis the Great, who also became king of Poland; but the same fatality of failure in the male line also befell this branch of the house of Anjou.

ANJOU, RENÉ, DUKE OF, was the second son of Duke Louis II., and succeeded his brother Duke Louis III. He was born at Angers in 1408, and brought up by his uncle, Louis of Bar, who, in 1419, contracted a marriage between him and Isabella, heiress of Lorraine, and, in 1430, left him in possession of his duchy. On the death of Charles of Lorraine in 1431, René was acknowledged as his successor, but he had soon to defend himself against the claims of the count of Vandemont, who was supported by Philip of Burgundy. The battle of Boulogneville decided in favor of the count, and René was taken prisoner to Dijon by Philip. He died at Aix in 1480.

ANKARSTROM, JOHAN JAKOB, the assassin of Gustavus III., king of Sweden, was born in 1759 and executed in 1792.

ANKLAM, or **ANCLAM**, a town of Prussia, in the province of Pomerania, situated on the Peene, six miles from its mouth in the Kleine Haff, and forty-seven northwest of Stettin. Population, 12,784.

ANKOBAR, or **ANKOBER**, the capital of the kingdom of Shoa in Abyssinia, on a mountain about 8,200 feet above the level of the sea.

ANNA, an Indian coin, the sixteenth part of a rupee.

ANNA, ANA, or **ANAH**, a town of Turkey in Asia, situated on the right bank of the Euphrates, about 160 miles northwest of Bagdad.

ANNA CARLOVNA, who for a few months held the position of regent in Russia, was the daughter of Catherine, sister of the Empress Anna Ivanovna, and was born in 1718 and died in 1745.

ANNA COMNENA, daughter of the emperor Alexius Comnenus I., was born December 1, 1083. She was her father's favorite, and was carefully trained in the study of poetry, science, and Greek philosophy. With a mind superior to the effeminacy and voluptuousness of the court in which she was educated, she cultivated literature and sought the acquaintance of the more eminent philosophers of the period. She died in 1148.

ANNA, SAINT, according to tradition, the wife of St. Joachim, and mother of the Virgin Mary. She is the patron saint of carpenters and her festival is held on July 26th.

ANNA IVANOVNA, Empress of Russia, daughter of Ivan, brother of Peter the Great, was born in 1693, and married in 1710 to the duke of Courland, who died the following year. After the death of Peter II., in 1730, the imperial council offered the vacant throne to Anna on the following conditions:—She was to govern according to the decisions of the supreme council, and she was not allowed, without its consent, either to declare war or to conclude peace, to impose new taxes, to grant any important office of the state, to dispose of crown lands, to contract a matrimonial alliance, or to nominate a successor to the throne. She was also not to punish any noble, or to confiscate any one's property without a legal sentence. Anna signed these conditions without any demur; but after her arrival at Moscow, a numerous party, jealous of the authority which this constitution, imitated from that of Sweden, gave to the supreme council, or rather to the families of the Princes Dolgorouki and Galitzin, of whose members it was chiefly composed, petitioned the empress to assume the autocracy of her predecessors. Anna immediately complied with this request, and the framers of the constitution either were banished to Siberia, or perished on the scaffold. Russia was governed in the most tyrannical and oppressive manner during the whole reign of Anna by her favorite Biren, who was made by her influence duke of Courland. Anna died in 1740. Her reign is considered as a period of transition from the old Muscovite semi-barbarian manner to the polish, though not the civilisation, of the West.

ANNA, BALDASARRE D', a painter of some repute, who flourished during part of the 16th and 17th centuries. He was born at Venice, probably about 1560, and is said to have been of Flemish descent. The date of his death is uncertain, but he seems to have been alive in 1639.

ANNABERG, a town of Saxony, situated in the Erzgebirge, about 1830 feet above the level of the sea, and at a distance of 18 miles south from Chemnitz, with which it is connected by railway. Population, 13,882.

ANNALS (*Annales*, from *annus*, a year), a concise historical record in which events are arranged chronologically, year by year.

ANNAMABOE, or **ANAMABOE**, a British fort and town on the Gold Coast of Africa, about ten miles east-northeast of Cape Coast Castle. Population, 5,000.

ANNAN, a royal and parliamentary burgh of Scotland, in the county of Dumfries, situated on the river Annan, nearly two miles from the Solway Firth, and about fifteen from Dumfries. Population, 3,366.

ANNAN, a river rising near the source of the Tweed, in the range of hills that lies on the confines of the contiguous counties of Dumfries, Lanark, Peebles, and Selkirk.

ANNAPOLIS, the capital of Maryland, situated about two miles from Chesapeake Bay, and about twenty-five from Washington, with which it is connected by railway. The city was settled in 1649, and chartered in 1708. It is handsomely laid out and well built, containing the State capitol building, the governor's mansion, court-house, seven churches, two banks, two daily and four weekly newspapers, and a number of schools and academies. It is also the location of the United States Naval School, established in 1845, and of St. John's College, founded in 1789, containing, in addition to these, a convent and house of the Redemptionists. Glass works, ship building, and other industries are carried on, and the trade in canned fruits and oysters is annually increasing. The population of the city in 1900 was 8,525.

ANNAPOLIS, a town of Nova Scotia, capital of Annapolis county, and up to 1750 of the whole penin-

sula, situated on an arm of the bay of Fundy, at the mouth of a river also called Annapolis, 95 miles west of Halifax. Population, (1901), 1,019.

ANN ARBOR, a town of the United States, the capital of Washtenaw county, Michigan, situated upon Huron river, about forty miles west of Detroit, with which it is connected by the Michigan Central railway. It is the seat of the University of Michigan, a liberally-endowed institution, founded in 1837, and at present containing three subsidiary colleges devoted to law, medicine, and literature respectively, with a total attendance, in 1901, of 3,800 students. The city maintains a school system of unsurpassed excellence, and contains a number of churches, three banks, six weekly papers, one tri-weekly and four monthly periodicals, a number of hotels, and public halls with a capacity of 7,000, with other advantages and improvements. The manufacturing industries embrace pianos, organs, carriages, lumber and lumber products, iron hollow ware, notions, and other lines, employing large investments of capital and many operatives. Gas and electric lights are successfully utilized, facilities for communication with all parts of the city are available, and the departments of fire, police, etc., are ample. Population in 1900, 14,509.

ANNATES. As early as the 6th century it began to be customary for those who were ordained to ecclesiastical offices to pay a fee or tax to the ordaining authorities; and this tax at length amounted to a half or the whole of a year's income. This tax was called *annates*, and was paid to various superiors.

ANNATTO, the reddish pulp surrounding the seeds of *Boxa orellana*, a tree found in South America. Annatto is used in dyeing cloth, and for giving a yellow color to butter and cheese.

ANNE, Queen of Great Britain and Ireland, was born February 6, 1664. She was the second daughter of James, Duke of York, afterward James II. She was only seven years old when her mother, Anne Hyde, died, having previously professed adherence to the Church of Rome, a step which was immediately imitated by her husband. The duke, however, had to allow his daughters, the Princesses Mary and Anne, to be brought up as Protestants; and Anne always continued to be attached, zealously and even bigotedly, to the Church of England. In her twentieth year she was married to Prince George, the brother of the King of Denmark.

On March 8, 1702, Anne became queen of England by the death of William, being then thirty-eight years of age. Into her short reign there were crowded events possessing vast importance, both for the British Empire and for the whole of Europe; and her name is customarily associated with one of the most characteristic epochs in the history of English literature. She was seized with apoplexy, and died August 1, 1714.

ANNEALING is the process of removing the brittleness peculiar to glass vessels and metal castings immediately after manufacture. Newly-blown glass is so fragile as to be altogether unfit for use; and the common occurrence of the breaking of a lamp-glass on lighting the lamp, or of a tumbler in pouring in hot water, shows the want of proper annealing.

The process consists generally in heating the vessels up to a red or white heat in a close oven, and allowing them to cool gradually over a space of several hours or even days.

The large sheets of plate glass, now used for shop windows require to be very carefully annealed before being ground and polished, otherwise they would be unable to stand the scratching of the surface. Imperfection in this respect is often revealed by the spreading in

every direction of a crack once begun. Those plates require as long as a fortnight to complete the annealing; and smaller articles from six to sixty hours, according to their thickness and weight.

In the manufacture and working of the various metals, annealing is frequently employed to reduce the brittleness usually resulting from a rapid or important change of molecular structure, such as is produced by hammering, long-continued vibration, rolling, and sudden cooling. The coppersmith who hammers a flat sheet of copper into a vessel of any description he pleases, must leave off hammering at intervals, and anneal the piece of metal to prevent it going to pieces under his blows. The extreme degree of tenuity to which gold is reduced by heating, is attainable only by very frequent and careful heating and slow cooling at each stage of the processes of forging, rolling and beating.

Wheels and axles of railway carriages, from the constant vibration to which they are subjected, become, in course of time, dangerously brittle; and they require to be re-worked and annealed anew to restore the requisite toughness to the material. So also in the processes of metal rolling and wire-drawing, frequent annealing is necessary to allow the cohesive force to produce the most stable arrangement of the particles. The soft metals, such as lead, tin, and zinc, are annealed by immersion in water, which is made to boil and then cool slowly. Sudden changes of temperature have the effect, almost invariably, of rendering metals brittle. And, as sudden cooling is required to give to steel its peculiar and invaluable hardness, so unfortunately it renders it at the same time brittle as unannealed glass, from the unnatural strain which the inner substance of the metal possesses. Annealing must, therefore, be employed to reduce this molecular strain, and to give the steel a workable flexibility. This is done by raising it to a red heat within a close vessel, and then allowing it gradually to cool. Heating in an *open* fire is very injudicious, because the carbon which enters the steel as an element combines with the oxygen of the air to the detriment of the quality of the steel. Usually steel goods are heated in an iron oven with charcoal powder, or placed in the heart of hot cinders, so as to exclude all air and oxygen. Large castings, such as are used in the manufacture of cannon, are kept covered with hot cinders and allowed to cool down sometimes over a space of about three months.

Annealing may be said to be the inverse process of *tempering*, which is the fixing of the molecular condition of steel by more or less sudden cooling from a particular temperature.

ANNECY, a town of France, in the department of Haute Savoie, situated at the foot of the lake of Annecy, 22 miles south of Geneva. Population, 17,500.

ANNELIDA, a class of the sub-kingdom Annulosa, the title being derived from Lamarck's term *Anpélides* (*Anellus*, a little ring), given to Cuvier's red-blooded worms. The latter was included by Linnæus under his *Vermes*, along with intestinal worms, molluscs, zoophytes, and sponges. The labors of Pallas, Baster, Otto Fabricius, and especially O. F. Müller, enabled Gmelin, in the 13th edition of the *Systema Naturæ* of the great Swede, to make some improvements and many additions. Cuvier ranged the Annelida under his *Articulata*, giving them the chief position on account of their red blood; but they are now generally classified as a separate type below the latter. It would be out of place to enumerate all the advances that have occurred since Cuvier's time, but among those whose names stand prominently forward in this respect are Lamarck, De Blainville, Bosc, Audouin, Milne-Edwards, Dugès, Moquin-Tandon, and De Quatrefages in France; Van

Beneden, Morren, and D'Udekem in Belgium; Grui thuisen, Oken, H. Rathke, Grube, Max Schultze, Hoffmeister, Hering, Kölliker, Schmarda, Keferstein, Ehlers, and Ratzel in Germany; Claparède in Switzerland; Malmgren, Metschnikoff, and Kowalevsky in Russia; Sars in Norway; Kinberg and Lovén in Sweden; Delle Chiaje in Italy; Stimpson, Leidy, A. Agassiz, and Verrill in North America; and Montagu, Dalyell, G. Johnston, J. R. Johnson, Williams, Huxley, Baird, and Ray Lankester in England.

The Annelida may be described as bilaterally symmetrical animals, with flattened or cylindrical bodies, composed of rings, or without such. The locomotive appendages (generally furnished with bristles) are not articulated. Nervous system consisting of a cephalic ganglion or pair of ganglia, connected on each side of the oesophagus with a chain of ganglia running along the ventral aspect. Mouth ventral; alimentary canal with an anus. Circulatory system with distinct vessels. The majority are small animals, but some reach the length of 6 feet and upwards, and are as thick as a finger.

In regard to beauty of form and color, complex structure and wonderful habits the Polychæta are not surpassed by any invertebrate class. The splendid bristles of the Aphroditidæ, constantly glistening with all the hues of a permanent rainbow, the brilliant tints of the Phyllodocidæ, Hesionidæ and Nereidæ, and the gorgeous branchial plumes of the Terebellidæ, Sabellidæ, and Serpulidæ, can only be compared with the most beautiful types of butterflies and birds.

The class Annelida has been divided into the sections *Branchiata* and *Abranchiata*, the former comprehending the Polychæta, the latter the other groups; but this does not always hold good, since many Polychæta have no branchiæ. The latter, again, have been separated into the Dorisbranches and Cephalobranths, the former corresponding to the Maricola, Errantia, or Nereidæ of others, the latter to the Tubicola or Sedentaria. Grube's divisions, Rapacia and Limivora, are based on the nature of their food. In the present state of the department it will suffice to indicate the following families (after Malmgren) under which the Annelida Polychæta have been ranged, and to refer for further information to the *Annelides* of De Quatrefages, the *Familien* of Grube, the *Chatopoda* of Ehlers, the *Annelides Chétopodes* of Claparède, the *British Museum Catalogue* by Johnston and Baird, and the various works of Kinberg and Malmgren:—EUPHIROSYNIDÆ, AMPHINOMIDÆ, APHRODITIDÆ, POLYNOIDÆ, ACETIDÆ, SIGALIONIDÆ, NEPHTHYDIDÆ, PHYLLODOCIDÆ, HESIONIDÆ, ALCIOPIDÆ, TOMOPTERIDÆ (provisionally), SYLLIDÆ, NEREIDÆ, STAUROCEPHALIDÆ, LUMBRINCONEREIDÆ, EUNICIDÆ, ONUPHIDIDÆ, GONIADIDÆ, GLYCERIDÆ, ARICIIDÆ, OPHELIIDÆ, SCALIBREGMIDÆ, TELETHUSIDÆ, SPHERODORIDÆ, CHLORÆMIDÆ, STERNASPIDÆ, CHÆTOPTERIDÆ, SPIONIDÆ, CIRRATULIDÆ, CAPITULIDÆ, MALDANIDÆ, AMMOCHARIDÆ, HERMELLIDÆ, AMPHICTENIDÆ, AMPHARETIDÆ, TEREPELLIDÆ, SABELLIDÆ, ERIOPHAGIDÆ, and SERPULIDÆ.

The A. OLIGOCHÆTA are annelids without tentacles, cirri, or specialised branchial processes. Bristles, variously grouped, from two to eight and upwards in each transverse series. They are hermaphrodite, and the young undergo no metamorphosis.

The body is enveloped in a delicate cuticle resembling that of the Polychæta, and pierced by many pores. Underneath is a cellulose-granular hypoderm, with numerous glands. The setæ are simple, bifid, or hair-like. The muscular layers are an external circular, and an internal longitudinal, marked by the bristle sacs. The foregoing tissues enclose a perivisceral space, with the

usual septa and the characteristic corpuscles in a coagulable lymph, which performs important functions in the economy.

ANNESLEY, ARTHUR. See ANGLESEA, Earl of.

ANNEXATION is the adding or joining to a state of territory previously independent or belonging to another state. Most often it is the result of war, but occasionally is peacefully effected by treaty or as the result of royal marriages. Of instances in late years may be named the absorption of greater part of India, of much of Africa, and of all of Burmah by the English; that of Nice and Savoy by France; that of Alsace-Lorraine by Germany, and that of the Bolivian seaboard and part of Peru by Chili. In the United States the young cities are constantly increasing their territorial bounds by the annexation of adjoining villages and townships. This is done by popular vote and requires a majority vote of the citizens of each municipality in its favor.

ANNI, or ANI, the ancient *Abnicum*, a ruined city of Turkey in Asia, in Armenia, situated about 25 miles E.S.E. of Kars, in a rocky ravine, past which the Arpa-Chai, a tributary of the Aras or Araxes, flows. Anni was the capital of the Pakradian or Bagratian dynasty of Armenian kings, and under their rule reached the height of its greatness.

ANNISTON, a town of Calhoun county, Alabama, is located at the foot of the Blue Mountains, on the East Tennessee, Virginia and Georgia; Anniston and Atlantic; and Georgia Pacific railroads. It is the center and distributing point for the richest agricultural and mineral territory of Alabama, and is described as the "model city of the South." It contains three banks, two daily papers, several churches, schools, hotels, etc., many stores, an opera house, and handsome public and private edifices. The growth of the city has been phenomenal and substantial. It is now one of the leading manufacturing points south of the Ohio river, its productive industries embracing foundries, nail works, machine shops, etc. It is lighted by gas and electric lights, and enjoys other facilities for future growth and development of unrivaled and exceptional character. Population, (1900), 9,605.

ANNA BOM, or ANNABONA, a small island off the west coast of Africa, 190 miles west of Cape Lopez. Its length is about four miles, its breadth two; and, rising in some parts to a height of nearly 3,000 feet above the sea, it presents a succession of beautiful valleys and steep mountains, that are covered with rich woods and luxuriant vegetation.

ANNONAY, a town of France, in the department of Ardèche, irregularly but picturesquely built on several small hills at the confluence of the rivers Canse and Deôme, 37 miles south of Lyons. Population about 16,000.

ANNUAL PLANTS are those which complete the whole course of their development in one season, during which they germinate, flower, perfect their seeds, and perish, never to spring again from the same root. Most kinds of grain are the produce of annual grasses. Of garden flowers there may be named the cockscomb, china aster, phlox and marigold. Hardy annuals may be sown in autumn and will bloom in spring.

ANNUITIES. By an annuity is meant a periodical payment, made annually, or at more frequent intervals, either for a fixed term of years, or during the continuance of a given life, or a combination of lives, as will be more fully explained further on. In technical language an annuity is said to be payable for an assigned *status*, this being a general word chosen in preference to such words as "time," "term," or "period," because it may include more readily either a term of years certain, or a life or a combination of lives. The magnitude of

the annuity is the sum to be paid (and received) in the course of each year. Thus, if \$100 is to be received each year by a person, he is said to have an annuity of \$100. If the payments are made half-yearly, it is sometimes said that he has "a half-yearly annuity of \$100;" but to avoid ambiguity, it is more commonly said he has an annuity of \$100, payable by half-yearly instalments. The former expression, if clearly understood, is preferable on account of its brevity. So we may have quarterly, monthly, weekly, daily annuities, when the annuity is payable by quarterly, monthly, weekly, or daily instalments. An annuity is considered as accruing during each instant of the status for which it is enjoyed, although it is only payable at fixed intervals.

If an annuity is payable for a term of years independent of any contingency, it is called an annuity certain; if it is to continue for ever, it is called a perpetuity; and if in the latter case it is not to commence until after a term of years, it is called a deferred perpetuity. An annuity depending on the continuance of an assigned life or lives, is sometimes called a life annuity; but more commonly the simple term "annuity" is understood to mean a life annuity, unless the contrary is stated. A life annuity, to cease in any event after a certain term of years, is called a temporary annuity. The holder of an annuity is called an annuitant, and the person on whose life the annuity depends is called the nominee.

The theory of annuities certain is a simple application of algebra to the fundamental idea of compound interest. According to this idea, any sum of money invested, or put out at interest, is increased at the end of a year by the addition to it of interest at a certain rate; and at the end of a second year, the interest of the first year, as well as the original sum, is increased in the same proportion, and so on to the end of the last year,—the interest being, in technical language, converted into principal yearly. Thus, if the rate of interest is 5 per cent., \$5 improved at interest will amount at the end of a year to \$5.25, or, in conformity with a previous remark, 1 will at the end of a year amount to 1.05. At the end of a second year this will be increased in the same ratio, and then amount to (1.05)². In the same way, at the end of a third year, it will amount to (1.05)³, and so on.

We pass on now to the consideration of the theory of life annuities. This is based upon a knowledge of the rate of mortality among mankind in general, or among the particular class of persons on whose lives the annuities depend. If a simple mathematical law could be discovered which the mortality followed, then a mathematical formula could be given for the value of a life annuity, in the same way as we give above the formula for the value of an annuity certain. In the early stage of the science, Demoivre propounded the very simple law of mortality which bears his name, and which is to the effect, that out of 86 children born alive 1 will die every year until the last dies between the ages of 85 and 86. The mortality, as determined by this law, agreed sufficiently well at the middle ages of life with the mortality deduced from the best observations of his time; but, as observations became more exact, the approximation was found to be not sufficiently close.

ANNUNCIATOR, an electrical appliance or device consisting of a gong and indicators, with numbers attached, and so constructed that when a button, opening or closing the circuit in a distant part of a hotel or public building, is touched, the gong is made to ring, and the indicator is deflected from its normal position, showing, by its number, the point at which the button was touched. Its principal use is to summon attendants or to give an alarm. It is also part of a TELEPHONE (*q. v.*)

ANNUNCIATION, the announcement made by the angel Gabriel to the Virgin Mary of the incarnation of Christ (Luke i. 26-28).

ANODYNE denotes etymologically anything which relieves pain. The common usage of the word restricts it, however, to medicines which lessen the sensibility of the brain or nervous system, without acting directly on the cause of pain. The term is, however, loosely applied by medical practitioners to medicines which ease pain, regardless of the manner of their action, whether this action be directly upon the nervous system or indirectly upon it by means of their primary action upon the heart and vascular system. Some of the narcotics and acro-narcotics are not anodynes in the restricted sense.

ANOINTING, the practice of pouring an aromatic oil upon the head or over the whole body, has been in use from the earliest times among Oriental nations, from whom it passed, chiefly in its ceremonial application, to the nations of the west. It served three distinct purposes, being regarded as a means of health and comfort, as a token of honor, or as a symbol of consecration. Reasoning from analogy, it seems probable that anointing was practiced for sanative reasons before it became a religious ceremonial, but it is impossible to determine this with certainty. Its adoption as a sanative agent was dictated chiefly by the conditions of climate in the East. Used as it generally was in conjunction with the bath, it closed the pores, repressed undue perspiration, and so prevented loss of strength.

ANOKA, the county seat of Anoka county, Minn., is handsomely and accessibly situated on the Mississippi river near the mouth of what is known as Rum river, fifteen miles north of Minneapolis, and in the center of one of the richest agricultural districts in the State. The water-power obtainable here is of great value, not only on account of its efficiency, but because of its economy, and its employment both for manufacturing and other purposes in general. The railway facilities available embrace the St. Paul, Minneapolis and Manitoba and the Northern Pacific systems. The city contains a court-house, several hotels, and an opera house. A thoroughly equipped and liberally sustained school system is provided. The lines of manufacture are both numerous and varied, including starch works, being among the largest and most productive in the Northwest; lumber, boots and shoes, flour, meal, etc., sash, doors and blinds; there are also foundries and machine shops, carriage and wagon works, furniture and cigar factories, brick works, etc. Population, 6,000.

ANOMALISTIC YEAR, the interval between two successive passages of the earth through its perihelion, or point of nearest approach to the sun. The disturbing influence of other planets causes the perihelion to advance slowly in the direction of the earth's motion, so that the anomalistic year is 4 minutes 39 seconds longer than the sidereal year, and equals 365 days, 6 hours, 13 minutes, 49 seconds.

ANOMALY (Greek *anomalía*, "irregularity"), the angle measured at the sun between a planet in any point of its orbit and the last perihelion. It is so called because the first irregularities of planetary bodies were discovered in the discrepancy between the actual and computed distance. The anomaly was formerly measured from the aphelion, the opposite point of the ellipse, but as the aphelia of most comets lie beyond the range of observation, the perihelion is now taken as the point of departure for all planetary bodies.

ANOUKIS, or **ANAKA**, the name of an Egyptian goddess, one of the contemplar or companion goddesses of Khnum or Chnoumis. Her name meant "the Clasper" or "Embracer."

ANOPILOTHERIUM, a genus of extinct even-toed hoofed animals, established by Cuvier from bones found in the gypseous strata near Paris. The size of the animal was about that of the ass.

ANQUETIL, **LOUIS PIERRE**, a French historian, was born at Paris, January 21, 1723. He was for some time director of the academy at Rheims, and published in 1757 three volumes of a history of that city. In 1759 he was appointed prior of de la Roe, and soon after director of Senlis. He died December 6, 1808.

ANQUETIL DU PERRON, **ABRAHAM HYACINTHE**, an eminent Oriental scholar, brother of the subject of the preceding article, was born at Paris, December 7, 1731. He was a distinguished student at the university of that city, and at first intended to enter the church; but his taste for Hebrew, Arabic, Persian, and other languages of the East, developed into a passion, and he discontinued his theological course to devote himself entirely to them. His diligent attendance at the Royal Library, and his ardor in the prosecution of his favorite studies, attracted the attention of the keeper of the manuscripts, the Abbé Sallier, whose influence procured for him a small salary as student of the Oriental languages. He had scarcely received his appointment, when, lighting on some manuscripts in the Zend, he formed the project of a voyage to India, with the view of discovering the works of Zoroaster. In 1771 he published in three volumes 4to, the *Zend-Avesta*, containing collections from the sacred writings of the Persians, a life of Zoroaster, and fragments of works ascribed to that sage. He died January 17, 1805.

ANSARS, or **NOSSAIRIANS**, an Arab sect living in northern Syria near the mountains of Lebanon, and numbering about 75,000. They are of the Shiite sect and reverence Ali, the nephew of Mohammed, and their prophet Nossair.

ANSBACH, or **ANSPACH**, originally **ONOLZBACH**, a town of Bavaria, capital of the circle of Middle Franconia, and formerly of the margraviate of Ansbach, situated on the Rezat, twenty-five miles southwest of Nuremberg. Population, 14,057.

ANSELL, **RICHARD**, born at Liverpool, England, in 1815; became noted as a landscape and animal painter, was made A. R. A. in 1861 and an Academician in 1870. He died April 20, 1885.

ANSELM, Archbishop of Canterbury, was born in 1033, at or near Aosta, in Piedmont. His family was accounted noble, and he was possessed of considerable property. At the early age of fifteen he desired to devote himself to the service of God by entering a convent. He left home, and with only one attendant crossed the Alps, and wandered through Burgundy and France. Attracted by the fame of his countryman, Lanfranc, then prior of Bec, he entered Normandy, and, after spending some time in Avranches, settled at the monastery of Bec. There, at the age of twenty-seven, he became a monk; three years later, when Lanfranc was promoted to the abbacy of Caen, he was elected prior. This office he held for fifteen years, and then, in 1078, on the death of Herluin, he was made abbot. Under his rule Bec became the first seat of learning in Europe, a result due not more to his intellectual powers than to the great moral influence of his noble character, and his loving, kindly discipline. Anselm paid frequent visits to England in connection with the convent lands, and by his mildness of temper and unswerving rectitude, so endeared himself to the English that he was looked upon and desired as the natural successor to Lanfranc, then archbishop of Canterbury. But on the death of that great man, the ruling sovereign, William Rufus, seized the possessions and revenues of the see, and made no new appointment. About four years after, in 1092,

Anselm crossed to England. He was detained by business for nearly four months, and when about to return, was refused permission by the king. In the following year William fell ill, and thought his death was at hand. Eager to make atonement for his sin with regard to the archbishopric, he nominated Anselm to the vacant see, and, after a great struggle, compelled him to accept the pastoral staff of office. After obtaining dispensation from his duties in Normandy, Anselm was consecrated in 1093. He demanded of the king that he should give up all the possessions of the see, accept his spiritual counsel, and acknowledge Urban as pope, in opposition to the anti-pope, Clement. He only obtained a partial consent to the first of these, and the last involved him in a serious difficulty with the king. It was a rule of the church that the consecrations of metropolitans could not be completed without their receiving from the hands of the Pope the *Pallium*, or robe. Anselm, accordingly, insisted that he must proceed to Rome to receive the pall. But William would not permit this; he had not acknowledged Urban, and he maintained his right to prevent any Pope being acknowledged by an English subject without his permission. A great council of churchmen and nobles, held to settle the matter, advised Anselm to submit to the king, but failed to overcome his mild and patient firmness. The matter was postponed, and William meanwhile privately sent messengers to Rome, who acknowledged Urban, and prevailed upon him to send a legate to the king, bearing the archiepiscopal pall. A partial reconciliation was then effected, and the matter of the pall was compromised. It was not given by the king, but was laid on the altar at Canterbury, whence Anselm took it. Little more than a year after, fresh trouble arose with the king, and Anselm resolved to proceed to Rome and seek the counsel of his spiritual father. With great difficulty he obtained a reluctant permission to leave, and in October 1097 he set out for Rome. William immediately seized on the revenues of the see, and retained them to his death. Anselm was received with high honor by Urban, and at a great council held at Baria, he was put forward to defend the Latin doctrine of the Holy Ghost against the objections of the Greek church. But Urban was too politic to embroil himself with the king of England, and Anselm found that he could obtain no substantial result. He withdrew from Rome, and spent some time at the little village of Schlavia. Here he finished his treatise on the atonement, *Cur Deus homo*, and then retired to Lyons. In 1100 William was killed, and Henry, his successor, at once recalled Anselm. But Henry demanded that he should again receive from him in person investiture in his office of archbishop, thus making the dignity entirely dependent on the royal authority. Now, the Papal rule in the matter was plain; all homage and investiture were strictly prohibited. Anselm represented this to the king; but Henry would not relinquish a privilege possessed by his predecessors, and proposed that the matter should be laid before the Holy See. The answer of the Pope reaffirmed the law as to investiture. A second embassy was sent, with a similar result. Henry, however, remained firm, and at last, in 1103, Anselm and an envoy from the king set out for Rome. The Pope, Paschal, reaffirmed strongly the rule of investiture, and passed sentence of excommunication against all who had infringed the law, except Henry. Practically this left matters as they were, and Anselm, who had received a message forbidding him to return to England, unless on the king's terms, withdrew to Lyons, where he waited to see if Paschal would not take stronger measures. At last, in 1105, he resolved himself to excommunicate Henry. His intention was

made known to the king through his sister, and it seriously alarmed him, for it was a critical period in his affairs. A meeting was arranged, and a reconciliation between them effected. In 1107 the king relinquished his right of investiture, and two years later Anselm died.

ANSELM, of LOAN, a famous theologian, was born of very humble parents at Laon before the middle of the 11th century. He is said to have studied under St. Anselm at Bec. About 1076 he taught at Paris with great success, but not long afterward removed to his native place, where his school for theology rapidly became the most famous in Europe. He died 1117.

ANSON, GEORGE, LORD, the famous circumnavigator, was born at Shuckborough Manor, Staffordshire, on the 22d of April, 1697. In 1757, he became first lord of the Admiralty, and in 1761, admiral of the fleet, in which rank he continued, with a very short interval, until his death; and the last service he performed was to convey Queen Charlotte to England. He died 6th June, 1762. No book ever met with a more favorable reception than *Lord Anson's Voyage Round the World*.

ANSONIA, a town of New Haven county, Conn., is situated on the Naugatuck river and on the New York, New Haven and Hartford road, being also the terminus of the New Haven and Derby railroad. Two papers are published here, and the city contains two banks, many stores, public buildings, etc., besides extensive manufactories of brass and copper goods, clocks and clock equipments, movements, etc., electrical supplies, flour, lumber and lumber products, foundries and machine shops, etc. Population (1900), 12,681.

ANSTEY, CHRISTOPHER, poet, was son of the Rev. Christopher Anstey, rector of Brinkley, Cambridgeshire, where he was born in 1724-5. His poetical works were collected in 1808 (2 vols.) by the author's son John, himself author of *The Pleader's Guide*, in the same vein with the *New Bath Guide*. He died on 3d August 1805.

ANSTRUTHER-EASTER, a royal and parliamentary burgh of Scotland, in the county of Fife, situated on the Firth of Forth, 9 miles S. of St. Andrews.

ANSTRUTHER-WESTER, also a royal and parliamentary burgh in Fifehire, close to Anstruther-Easter, from which it is separated by a small stream called the Dreal Burn.

ANT. The insects included under this name are divisible into two distinct groups, which exhibit important differences not only in structure but also in habits. The familiar ant (*Formica*), found in Britain and Europe generally, belongs to an order of insects known as the *Hymenoptera*, of which division the bees, wasps, hornets, are also well-known examples. But the *Termites*, or white ants—insects which also live in social communities, and which inhabit tropical regions—belong to a different order, and exhibit differences in several important respects from the ordinary ants.

The Hymenopterous insects are distinguished by the possession of four membraneous wings, although in certain exceptional instances—as among certain members of the ant community—the wings may be wanting. The organs of the mouth are partly fitted for mastication by the development of jaws, and partly for suctional purposes by the possession of a proboscis or "antlia." The females of this order generally possess a terminal abdominal appendage, forming a "sting" (*aculeus*), or which may be used in the deposition of the eggs, when it is termed an *ovipositor*. The Hymenoptera, besides, undergo a "complete" metamorphosis,—that is, in their passage from the egg towards adult or mature existence they appear first as grubs, or *larvæ*, then are enclosed in a pupa-case, and finally appear as the perfect, and generally winged insect, or "imago." The Hymen-

optera exhibit, perhaps, the most remarkable development among insects of the faculty of instinct, and constitute excellent examples of so-called "social" insects, living in communities regulated by definite laws, each member of the society bearing a separate and well-defined part in the organisation and arrangement of the colony at large.

A brief description of the *Termites*, or white ants, may appropriately conclude the present article. These forms have already been stated to be entirely different from the familiar and true ants, and to belong to the Neuropterous insects, whereas the true ants are classed with the *Hymenoptera*. They resemble the true ants in living in highly organised social communities, and in being endowed with as high and as specialised instincts. But they differ from them, first, in the fact that they do not undergo a complete metamorphosis, that is, the Termite larvæ and pupæ resemble the perfect insect, and do not pass through the defined stages of change and development characteristic of the true ants, bees, and other insects. The young Termite, in fact, differs from the ordinary adult only in the non-possession of eyes, and from the sexual form in the non-development of wings. The white ants inhabit the tropical regions of the world generally, but are found in the greatest abundance in tropical South America. Their nests form characteristic structures, rising sometimes to a height of 5 or 6 feet, and constructed of earthy particles worked into a mass as hard and durable as stone. Many species of Termites are known, but they resemble one another in essential structure and habits. As indicated by their popular name, they are of a whitish color and are soft-bodied. The Termite community consists, as in the true ants, of males, females, and workers or neuters. In the true ants the latter are undeveloped females, whereas in the Termites the sex of the neuters is wholly undeterminable; and in addition the workers are invariably divided into two distinct classes: the "soldiers," with largely-developed jaws, whose sole office is to defend the community; and the ordinary "workers," on whom devolves the entire labor of the nest. Both classes of neuters are blind; and from a close examination of the eggs, the distinctions, not only between males and females, but also between the soldiers and workers, may be easily seen. The difference in food, so powerful in the development of sex and characteristics in other insects, does not therefore operate in the case of the Termites. The entire white ant colony and species also exhibit a division into subordinate groups and classes, the recognition and characters of which are very difficult of determination. And on this, as well as upon other grounds, the organisation of the white ant community is generally to be regarded as of a higher type than that of the familiar and true ants.

The nest of the Termites is known as a *termitarium*, the essential internal arrangement of which consists of a large number and series of chambers, connected by galleries and passages. Entrance to the nest is afforded by concealed roads, and subterranean passages. A large hillock may be a compound termitarium, formed by and inhabited by different species; and certain kinds of Termites build their nests of smaller size, sometimes of the consistence of paper. Their structures may be attached to the branches of trees, or they may be entirely subterranean, or concealed under the bark or within the stems of trees. The latter species are those which destroy timber, furniture, and household objects.

ANTÆUS, in Greek Mythology, a giant of Lybia, the son of Poseidon and Ge (Terra). He compelled all strangers passing through the country to wrestle with him, and as, when thrown, he derived fresh strength from each successive contact with his mother earth, he

proved invincible. With the skulls of those whom he had slain he built a temple to his father. Hercules, in combat with him, discovered the source of his strength, and lifting him up from the earth crushed him to death. The struggle between Antæus and Hercules is a favorite subject in ancient sculpture.

ANTALCIDAS, a Spartan politician, who rendered conspicuous service to his native state at one of the turning-points in Greek history. He comes first into notice as ambassador from Sparta to Tiribazus, the Persian satrap of Ionia, to sue for peace (393-2 B.C.) Upon hearing of this the Athenians, becoming anxious lest they should lose their growing ascendancy, also sent an embassy, at the head of which was Conon, to counteract the efforts of the Spartans. Tiribazus favored the cause of Sparta, and secretly supplied Antalcidas with the means of carrying on war against Athens. Artaxerxes, however, disapproving the conduct of his satrap, recalled him, and appointed Struthas, whose sympathies were on the side of Athens, in his place. But this check to the policy of Antalcidas was only temporary. In a few years circumstances became even more favorable than at first to a successful negotiation, Tiribazus having been restored to his satrapy, and accordingly, in 388-7, Antalcidas was again sent upon an embassy to Asia. By skillful diplomacy he succeeded in securing the active assistance of the Persian power against Athens. Appointed on his return admiral of the Spartan fleet, he carried on a naval warfare in a manner so vigorous, that the Athenians were glad to accept peace on the terms Artaxerxes chose to dictate. These were made known by Tiribazus to a congress of deputies from Sparta, Argos, and Athens, and formed the basis of "the peace of Antalcidas," so called from its being arranged in accordance with the views of the Spartan ambassador. Antalcidas seems to have been engaged in another mission to Persia in 371; but the latter incidents of his career are involved in uncertainty. Plutarch states that he committed suicide on the failure of his last mission, but there seems no proof of this.

ANTALO, a town of Tigré, in Abyssinia, capital of the district of Enderta, situated in lat. 13° 17' N., and long. 39° 28' E., on a plateau about 800 feet above the level of the sea, out of which a steep hill rises on the north of the town, while beneath it a wide plain stretches southward.

ANTARA, or, as he is usually called, ANTAR, an early Arabian warrior and poet, famous as the author of one of the poems hung up in the Kaaba at Mecca, and as the hero of a romance which bears somewhat the same relation to Arabic literature which the Arthurian legend bears to our own. He was the son of Shedad-el-Absi, a warrior in the army of Zoheir, by Zabuba, a negro slave who had been captured in some plundering exhibition; and, if we can trust the Arabian romancist, he bore strong evidence of his negro origin. He spent his youth in servitude and neglect, but soon became known for his strength and high-handedness. Before long, while yet a slave, he fell in love with his cousin, the beautiful Abla, whose praises are still preserved at Mecca, but at the same time had the misfortune to incur the hate of his father's wife, Shameeah. A number, however, of happy opportunities presenting themselves, he showed such extraordinary prowess against some hostile tribes, that his father was constrained to join in the public appreciation of his services, and to recognise him as his son. He now gradually rose in favor, and held for long a position of the greatest influence among his people, filling the surrounding country with the fame equally of his song and his sword. In a great war between two rival tribes, which lasted forty years, he is said to have played a very prominent part. The time

ANTELOPE.



Koodoo (Strepsiceros Koodoo)



Argali (Antelope leucurus)



Head of Prongbuck (Antilocapra americana)



Antelope

cornuta.



Common Antelope (Antelope cervicapra)



Water Bok (Kobus Ellipsiprymnus)

ANTELOPE.



Harnessed Antelope (Antelope scripta) Fern.



(Antelope rupicapra) Chama.

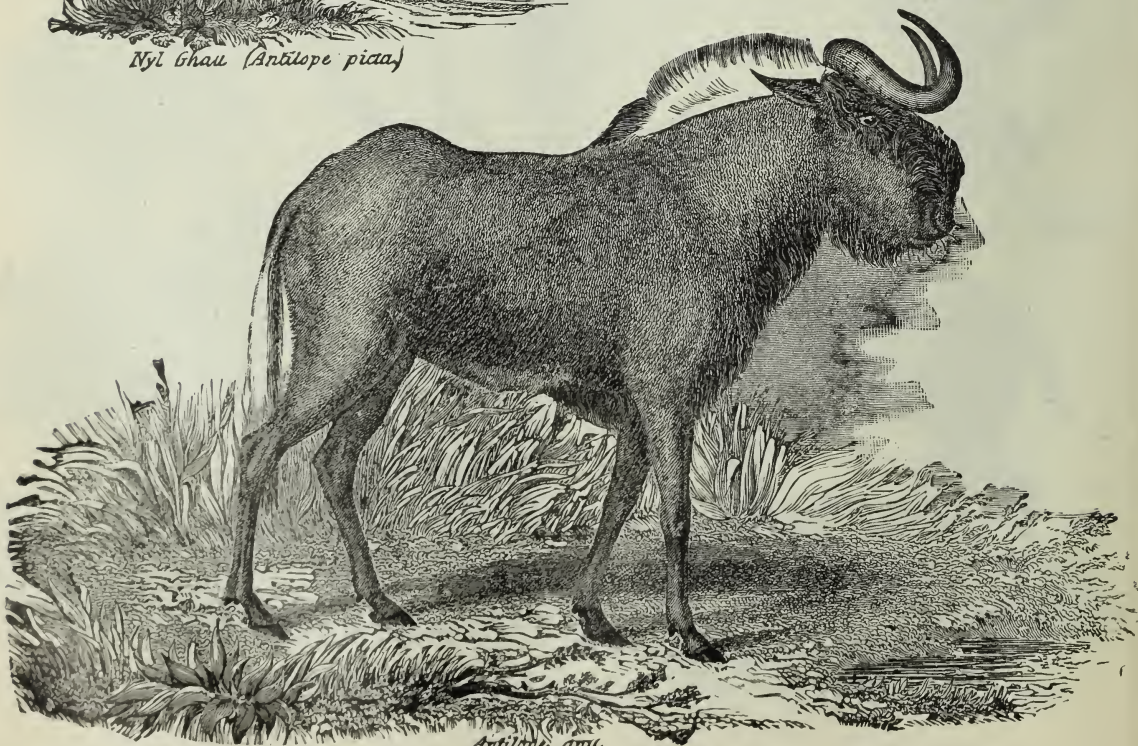


Nyl Ghau (Antelope picta)



Antelope

chickara.



Antelope gra.

and manner of his death are a matter of dispute.

ANTARCTIC OCEAN, a name that should, strictly speaking, be applied only to the ice-bound sea to the south of the antarctic circle; in practice, however, it is usually vaguely extended so as to include more or less of the cold regions round the south pole, without reference to the circle. See **POLAR REGIONS**.

ANT-EATERS, a family of South American mammals belonging to the insect-eating division of the order *Edentata*. The absence of teeth, the long head, tubular mouth, worm-like tongue, the marked development of the third digit of the fore-foot, and the insect diet are prominent characteristics of this family. The great ant-eater or ant-bear is found in the swamps of Demarara and South America. It measures four feet in length, not including the bushy tail, which is sometimes as long as the body. It breaks down the nests of the *termites*, or white ants, and captures the insects on the long tongue, which is covered with a viscid secretion. The name Ant-eater is given at the Cape of Good Hope to the Earth-hog or Aard-vark (See Vol. I, p. 2).

ANTELOPE. The term antelope is applied to denote a genus of *Mammalia*, included in the *Ungulate* or *Hoofed* order of that large class. Of the ungulate or hoofed mammals, the *Ruminants*, or those that "chew the cud," form a chief subdivision; and the antelopes, sheep, oxen, and goats, are included and classified together in this division as the family *Cavicornia*, or "hollow-horned" ruminants. The chief character by which the *Cavicornia* are distinguished from other families of the *Ruminantia* consists in the peculiar and characteristic type of structure of the horns. These appendages are essential processes of the frontal or forehead bone of the skull, and so far from being deciduous,—that is, being shed at stated periods,—as the deer, the horns in the *Cavicornia* are permanent and persistent throughout life.

The antelope family (*Antilopide*), including a great number of different species, is generally distinguished from the allied families of the sheep, oxen, and goats, by the light, graceful, and deer-like form of its members. The horns are chiefly cylindrical in shape, but may be twisted in an annular or spiral manner. The beard, or "dew-lap," characteristic of the deer tribe, is generally absent in the antelopes; and of all the *Cavicornia*, they constitute the only family in which the curious "tear-pits" or "lachrymal sinuses" of the eyes are found. These latter organs are small sacs situated below the eyes, and devoted to the secretion of a yellow substance of a sebaceous or waxy nature.

The American continent possesses but two representatives of the antelope family. These are the so-called Rocky Mountain sheep or goat—a true antelope—and the prongbuck or cabrit of North American regions. The Rocky Mountain sheep or goat (*Haplocerus laniger*), possessing a coat of long woolly hair, is closely related to the chamois of Europe; and in this form, as well as in the prongbuck, the connection between the antelopes and goats may be traced.

ANTENNÆ, a small Latin town, of great antiquity, built on the top of a hill that rose above the alluvial plain at the meeting of the Anio and Tiber.

ANTENNÆ, or feelers, the anterior appendages on the head of crustaceans, insects and myriapods. The lobster has two pairs of feelers, while insects and myriapods have only one pair. They are really "head-legs" modified for sensory purposes, and consist of a long series of joints.

ANTENOR, a Trojan elder of great prudence, who advised his fellow-townsmen to send Helen back to her husband, and in various ways showed himself not unfriendly to the Greeks.

ANTENOR, son of Euphranor, the native sculptor to whom the Athenians were indebted for the bronze statues of Harmodius and Aristogiton, which, after adorning the Ceramicus, were carried off to Susa by Xerxes, and restored, it is probable, by Alexander.

ANTEQUERA, an ancient city of the province of Malaga, in Spain, supposed to be the Roman *Antiquaria* or *Anticaria*, beautifully situated in a fertile valley on the south of the river Guadaljorce, 28 miles N. of Malaga, and 45 W. of Granada. Population 27,201.

ANTHELIA (Gr. *anti*, "opposite," and *hēlios*, "the sun"), are luminous rings seen on a cloud or fog which lies opposite the sun. They occur chiefly in Alpine regions and in the Polar seas, and are only visible when sunshine and cloud or fog occur at the same time. The occurrence of anthelia is caused by defraction of light.

ANTHEM is derived from the Greek, through the Saxon *Antefn*, and originally had the same meaning as antiphony. (See **ANTIPHONY**.) It is now, however, generally restricted to a form of musical composition peculiar to the service of the Church of England, and appointed by rubrics to follow the third collect at both morning and evening prayer, "in choirs and places where they sing."

ANTHEMIUS, a Greek mathematician and architect of great genius, who produced, under the patronage of Justinian (532 A.D.), the original and daring plans for the church of St. Sophia, in Constantinople, which strikingly displayed at once his knowledge and his ignorance.

ANTHESTERIA, an Athenian festival held annually in the month of Anthesterion, corresponding nearly to our February, at which time the wine stored at the previous vintage was considered fit for use. The object of the festival was to celebrate the arrival of that season, and the beginning of spring. It lasted three days, from the 11th to the 13th of the month.

ANTHOLOGY. The term anthology, literally denoting a collection of flowers, is figuratively applied to any selection of literary beauties, and especially to that great body of fugitive poetry, comprehending about 4500 pieces, by upwards of 300 writers, which is commonly known as the **GREEK ANTHOLOGY**.

Literary History of the Greek Anthology.—The art of occasional poetry had been cultivated in Greece from an early period,—less, however, as the vehicle of personal feeling, than as the recognized commemoration of remarkable individuals or events, or the accompaniment of votive offerings. Such compositions were termed epigrams, *i.e.*, inscriptions. The modern use of the word is a departure from the original sense, which simply indicated that the composition was intended to be engraved or inscribed. About 91 B.C., the sophist and poet, Meleager of Gadara, undertook to combine the choicest effusions of his predecessors into a single body of fugitive poetry. Collections of monumental inscriptions, or of poems on particular subjects, had previously been formed by Polemon the grammarian, Alcetas, and others; but Meleager first gave the principle a comprehensive application. His selection, compiled from forty-six of his predecessors, from Sappho downward, and including numerous contributions of his own, was entitled *The Garland*; and in an introductory poem each poet is compared to some flower, fancifully deemed appropriate to his genius. The arrangement of the collection was alphabetical, according to the initial letter of each epigram.

In the age of Tiberius (rather than of Trajan, as commonly stated) the work of Meleager was continued by another epigrammatist, Philip of Thessalonica, who first employed the term *anthology*. His collection included the compositions of thirteen writers subsequent

to Meleager. No further collection from various sources is recorded until the time of Justinian, when epigrammatic writing, especially in its amatory department, experienced a great revival at the hands of Agathias, the historian, Paulus Silentiarius, and their circle. Their ingenious but mannered productions were collected by Agathias into a new anthology, entitled *The Circle*; the first to be divided into books, and arranged with reference to the subjects of the pieces.

Five Greek anthologies, accordingly, existed at the commencement of the Middle Ages. The partial incorporation of these into a single body was the work of a certain Constantinus Cephalas, whose name alone is preserved in the single MS. of his compilation extant, but who probably lived during the temporary revival of letters under Constantine Porphyrogenitus, at the beginning of the 10th century. He appears to have merely made excerpts from the existing anthologies, with the addition of selections from Lucilius, Palladas, and other epigrammatists, whose compositions had been published separately. His arrangement, to which we shall have to recur, is founded on a principle of classification, and nearly corresponds to that adopted by Agathias. His principle of selection is unknown; it is only certain that while he omitted much that he should have retained, he has preserved much that would otherwise have perished. The extent of our obligations may be ascertained by a comparison between his anthology and that of the next editor, the monk Maximus Planudes (1320 A.D.), who has not merely grievously mutilated the anthology of Cephalas by omissions, but has disfigured it by interpolating verses of his own. We are, however, indebted to him for the preservation of the epigrams on works of art, which seem to have been accidentally omitted from our only transcript of Cephalas.

The Planudean was the only recension of the anthology known at the revival of classical literature, and was first published at Florence, by Janus Lascaris, in 1594. It long continued to be the only accessible collection, for although the Palatine MS., the sole extant copy of the anthology of Cephalas, was discovered at Heidelberg by Salmasius in 1606, it was not published until 1772, when it was included in Brunck's *Analecta Veterum Poetarum Græcorum*. This edition was superseded by the standard one of Friedrich Jacobs (Leipsic, 1794-1803, 13 vols.), the text of which was reprinted in a more convenient form in 1813-17, and occupies three pocket volumes in the Tauchnitz series of the classics. The best edition for general purposes is perhaps that of M. Dübner in Didot's *Bibliotheca* (Paris, 1864-72), which contains the Palatine Anthology, the epigrams of the Planudean Anthology not comprised in the former, an appendix of pieces derived from other sources, copious notes selected from all quarters, a literal Latin prose translation by Boissonade, Bothe, and Lapaume, and the metrical Latin versions of Hugo Grotius. The best edition of the Planudean Anthology is the splendid one by Van Bosch and Van Lennep (Utrecht, 1795-1822). Welcker, Meineke, and other German scholars have written valuable monographs on the Anthology.

ANTHON, CHARLES, an American philologist and professor of classics, was born in New York city in 1797, and died there 29th July 1867. After graduating with honors at Columbia College in 1815, he commenced the study of law, and in 1819 was admitted to the bar. But in 1820 he was appointed assistant professor of languages in his alma mater, and he thenceforth devoted himself solely to classical literature. Soon after he commenced his well-known editions of the classics, the best known being that of the *Poems of Horace*, with extensive notes and comments, published in 1830. In the latter year he

was made rector of the grammar school attached to his college, and in 1835 he succeeded to the chair of Professor Morse.

ANTHONY, SAINT, the founder of monasticism, was born at the village of Coma in Egypt 251 A.D. Inheriting a large fortune, he thought it his duty to distribute it among his neighbors and the poor, and to live a rigidly ascetic life. He spent several years in solitude, where, according to tradition, he was sorely tempted by the devil. Many disciples flocked to his retreat at Fayoom, and built their cells around his, thus forming the earliest monastic community. (See ABBEY.) Anthony visited Alexandria when upwards of a hundred years old, and took an important part in the controversy with the Arians,—a fact to which we are probably indebted for the record of the life of the saint written by Athanasius. Soon after returning to his cell he died (356 A.D.), his last injunction being that the place of his burial should be kept secret. For further details of Anthony's connection with the monastic system, see MONASTICISM.

ANTHRACITE, STONE COAL, KILKENNY COAL, or CULM, is a variety of coal differing from the common or bituminous kind in containing a larger proportion of carbon in its composition; that element being present in anthracite to the extent of from 90 to 95 per cent. of its entire mass, while the carbon in bituminous coal usually varies from 75 to 90 per cent. Anthracite is further distinguished by its compactness, high specific gravity, bright lustre, which is frequently iridescent on the natural surfaces, and its conchoidal fracture. It does not soil the fingers when handled, like ordinary coal; it ignites with difficulty, and burns with a feeble, smokeless flame, giving out an intense heat. No sharply defined line of demarcation can be drawn between anthracite and the bituminous varieties of coal, as the one series merges by imperceptible degrees into the other. This gradation is observable in the coal deposits themselves, anthracite and bituminous coal being frequently found not far removed in different parts of the same seam, and the gradual transformation from a flaming coal to a compact, lustrous, non-flaming kind, being easily traceable.

ANTHROPOLOGY (the science of man) denotes the natural history of mankind. In the general classification of knowledge it stands as the highest section of zoology or the science of animals, itself the highest section of biology or the science of living beings. To anthropology contribute various sciences, which hold their own independent places in the field of knowledge. Thus anatomy and physiology display the structure and functions of the human body, while psychology investigates the operations of the human mind. Philology deals with the general principles of language, as well as with the relations between the languages of particular races and nations. Ethics or moral science treats of man's duty or rules of conduct toward his fellow-men. Lastly, under the names of sociology and the science of culture, are considered the origin and development of arts and sciences, opinions, beliefs, customs, laws, and institutions generally among mankind, their course in time being partly marked out by the direct record of history, while beyond the historical limit our information is continued by inferences from relics of early ages and remote districts, to interpret which is the task of prehistoric archaeology and geology. Not only are these various sciences concerned largely with man, but several among them have in fact suffered by the almost entire exclusion of other animals from their scheme. It is undoubted that comparative anatomy and physiology, by treating the human species as one member of a long series of related organisms, have gained a higher and more perfect understanding of man himself and his

place in the universe than could have been gained by the narrower investigation of his species by and for itself. It is to be regretted that hitherto certain other sciences — psychology, ethics, and even philology and sociology — have so little followed so profitable an example. No doubt the phenomena of intellect appear in vastly higher and more complete organisation in man than in beings below him in the scale of nature, that beasts and birds only attain to language in its lower rudiments, and that only the germs of moral tendency and social law are discernible among the lower animals. Yet though the mental and moral interval between man and the nearest animals may be vast, the break is not absolute, and the investigation of the laws of reason and instinct throughout the zoological system, which is already casting some scattered rays of light on the study of man's highest organisation, may be destined henceforth to throw brighter illumination into its very recesses. Now this condition of things, as well as the accepted order in which the sciences have arranged themselves by their mode of growth, make it desirable that anthropology should not too ambitiously strive to include within itself the sciences which provide so much of its wealth, but that each science should pursue its own subject through the whole range of living beings, rendered to anthropology on account of so much of its results as concerns man. Such results it is the office of anthropology to collect and co-ordinate, so as to elaborate as completely as may be the synopsis of man's bodily and mental nature, and the theory of his whole course of life and action from his first appearance on earth. As will be seen from the following brief summary the information to be thus brought together from contributing sciences is widely different both in accuracy and in soundness. While much of the descriptive detail is already clear and well filled in, the general principles of its order are still but vaguely to be discerned, and as our view quits the comparatively distinct region near ourselves, the prospect fades more and more into the dimness of conjecture.

Opinion as to the genesis of man is divided between the theories of the two great schools of biology, that of creation and that of evolution. In both schools the ancient doctrine of the contemporaneous appearance on earth of all species of animals having been abandoned under the positive evidence of geology, it is admitted that the animal kingdom, past and present, includes a vast series of successive forms, whose appearances and disappearances have taken place at intervals during an immense lapse of ages. The line of inquiry has thus been directed to ascertaining what formative relation subsists among these species and genera, the last link of the argument reaching to the relation between man and the lower creatures preceding him in time.

The problem of the origin of man cannot be properly discussed apart from the full problem of the origin of species. The homologies between man and other animals which both schools try to account for; the explanation of the intervals, with apparent want of intermediate forms, which seem to the creationists so absolute a separation between species; the evidence of useless "rudimentary organs," such as in man the external shell of the ear, and the muscle which enables some individuals to twitch their ears, which rudimentary parts the evolutionists claim to be only explicable as relics of an earlier specific condition, — these, which are main points of the argument on the origin of man, belong to general biology. The philosophical principles which underlie the two theories stand for the most part in strong contrast, the theory of evolution tending toward the supposition of ordinary causes, such as "natural selection," producing modifications in species, whether by gradual

accumulation or more sudden leaps, while the theory of creation is prone to have recourse to acts of supernatural intervention. A theory has been propounded by Mr. Mivart (*Genesis of Species*, 1871) of a natural evolution of man as to his body, combined with a supernatural creation as to his soul; but this attempt to meet the difficulties on both sides seems at present not to have satisfied either. Anthropology waits to see whether the discovery of intermediate forms, which has of late years reduced so many asserted species to mere varieties, will go on till it produces a disbelief in any real separation between neighboring species, and especially whether geology can furnish traces of the hypothetical animal, man's near ancestor, but not as yet man. In the present state of the argument it may here suffice to have briefly indicated the positions held on either side.

The classification of mankind into a number of permanent varieties or races, rests on grounds which are within limits not only obvious but definite. Whether from a popular or a scientific point of view, it would be admitted that a Negro, a Chinese, and an Australian, belong to three such permanent varieties of men, all plainly distinguishable from one another and from any European. Moreover, such a division takes for granted the idea which is involved in the word race, that each of these varieties is due to special ancestry, each race thus representing an ancient breed or stock, however these breeds or stocks may have had their origin. The anthropological classification of mankind is thus zoological in its nature, like that of the varieties or species of any other animal group, and the characters on which it is based are in great measure physical, though intellectual and traditional peculiarities, such as moral habit and language, furnish important aid. Among the best-marked race-characters are the following:—

The color of the skin has always been held as specially distinctive. The colored race-portraits of ancient Egypt remain to prove the permanence of complexion during a lapse of a hundred generations, distinguishing coarsely but clearly the types of the red-brown Egyptian, the yellow-brown Canaanite, the comparatively fair Libyan, and the Negro. These broad distinctions have the same kind of value as the popular terms describing white, yellow, brown and black races, which often occur in ancient writings, and are still used. But for scientific purposes greater accuracy is required, and this is now satisfactorily attained by the use of Dr. Broca's graduated series of colors as a standard. By this table the varieties of the human skin may be followed from the fairest hue of the Swede and the darker tint of the Provençal, to the withered-leaf brown of the Hottentot, the chocolate brown of the Mexican, and the brown-black of the West African. The color of the eyes and hair is also to be defined accurately by Broca's table. This affords, however, less means of distinction, from the extent in which dark tints of hair and iris are common to races whose skins are more perceptibly different; yet some varieties are characteristic, such as the blue eyes and flaxen hair of the fair race of Northern Europe.

As to the hair, its structure and arrangement is a better indication of race than its tint. The hair differs in quantity between scantiness on the body of the Mongol and profusion on the body of the Aino; while as to the arrangement on the scalp, the tufts of the Bushman contrast with the more equal distribution on the European head. The straight hair of the North American or Malay is recognisable at once as different from the waving or curling hair of the European, and both from the naturally frizzed hair of the Negro. These marked differences are due to the structure of the hair, which, examined in sections under the microscope, varies from

the circular section proper to the straight-haired races, to the more or less symmetrically oval or reniform sections belonging to races with curled and twisted hair.

Stature is by no means a general criterion of race, and it would not, for instance, be difficult to choose groups of Englishmen, Kafirs, and North American Indians, whose mean height should hardly differ. Yet in many cases it is a valuable means of distinction, as between the tall Patagonians and the stunted Fuegians, and even as a help in minuter problems, such as separating the Teutonic and Celtic ancestry in the population of England (see Beddoe, "Stature and Bulk of Man in the British Isles," in *Mem. Anthropol. Soc. London*, vol. iii.) Proportions of the limbs, compared in length with the trunk, have been claimed as constituting peculiarities of African and American races; and other anatomical points, such as the conformation of the pelvis, have specially. But inferences of this class have hardly attained to sufficient certainty and generality to be set down in the form of rules.

The conformation of the skull is second only to the color of the skin as a criterion for the distinction of race.

Classification of races on cranial measurements has long been attempted by eminent anatomists, such as Blumenbach and Retzius, while the later labors of Von Baer, Welcker, Davis, Broca, Busk, Lucae, and many others, have brought the distinctions to extreme minuteness. In certain cases great reliance may be placed on such measurements. Thus the skulls of an Australian and a Negro would be generally distinguished by their narrowness and the projection of the jaw from that of an Englishman; while, although both the Australian and Negro are thus dolichocephalic and prognathous, the first would usually differ perceptibly from the second in its upright sides and strong orbital ridges.

The general contour of the face, in pari dependent on the form of the skull, varies much in different races, among whom it is loosely defined as oval, lozenge-shaped, pentagonal, &c. Of particular features, some of the most marked contrasts to European types are seen in the oblique Chinese eyes, the broad-set Kamchadal cheeks, the pointed Arab chin, the snub Kirghis nose, the fleshy protuberant Negro lips, and the broad Kalmuk ear. Taken altogether, the features have a typical character which popular observation seizes with some degree of correctness, as in the recognition of the Jewish countenance in a European city.

The state of adaptation in which each people stands to its native climate forms a definite race-character. In its extreme form this is instanced in the harmful effect of the climate of India on children of European parents, and the corresponding danger in transporting natives of tropical climates to England. Typical instances of the relation of race-constitutions to particular diseases are seen in the liability of Europeans in the West Indies to yellow fever, from which Negroes are exempt, and in the habitation by tribes in India of so-called "unhealthy districts," whose climate is deadly to Europeans, and even to natives of neighboring regions.

These classifications have been numerous, and though regarded as systems, most of them are now seen at the first glance to be unsatisfactory, yet they have been of great value in systematising knowledge, and are all more or less based on indisputable distinctions. Blumenbach's division, though published nearly a century ago (1781), has had the greatest influence. He reckons five races, viz., Caucasian, Mongolian, Ethiopian, American, Malay. The ill-chosen name of Caucasian, used by Blumenbach to denote what may be called white men, is still current; it brings into one race peoples such as the Arabs and Swedes, although these are scarcely less different than the Americans and Malays, who are set

down as two distinct races. On the whole, Professor Huxley probably approaches more nearly than any other to such a tentative classification as may be expected in definition of the principal varieties of mankind, regarded from a zoological point of view, though anthropologists may be disposed to erect into separate races several of his widely-differing sub-races. He distinguishes four principal types of mankind, the Australioid, Negroid, Mongoloid, and Xanthochroic, adding a fifth variety, the Melanochroic.

The special points of the Australioid are a chocolate-brown skin, dark brown or black eyes, black hair (usually wavy), narrow (dolichocephalic) skull, brow-ridges strongly developed, projecting jaw, coarse lips, and broad nose. This type is best represented by the natives of Australia, and next to them, by the indigenous tribes of Southern India, the so-called coolies. The Egyptians to some degree approach this type; they are, however, held by good authorities to be a modified African race.

The Negroid type is primarily represented by the Negro of Africa, between the Sahara and the Cape district, including Madagascar. The skin varies from dark brown to brown-black, with eyes of similar dark hue, and hair usually black, and always crisp or woolly. The skull is narrow (dolichocephalic), with orbital ridges not prominent, prognathous, with depressed nasal bones, causing the nose to be flat as well as broad; and the lips are coarse and projecting. Two important families are classed in this system as special modifications of the Negroid type. First, the Bushman of South Africa is diminutive in stature, and of yellowish-brown complexion; the Hottentot is supposed to be the result of crossing between the Bushman and ordinary Negroid. Second, the Negritos of the Andaman Islands, the peninsula of Malacca, the Philippines and other islands, to New Caledonia and Tasmania, are mostly dolichocephalic, with dark skins and woolly hair. In various districts they tend towards other types, and show traces of mixture.

The Mongoloid type prevails over the vast area lying east of a line drawn from Lapham to Siam. Its definition includes a short, squat build, a yellowish brown complexion, with black eyes and straight black hair, a broad (brachycephalic) skull, usually without prominent brow-ridges, flat small nose, and oblique eyes. The dolichocephalic Chinese and Japanese in other respects correspond. Various other important branches of the human species are brought into connection with the Mongoloid type, though on this view the differences they present raise difficult problems of gradual variation, as well as of mixture of race; these are the Dyak-Malays, the Polynesians, and the Americans.

The Xanthochroi, or fair whites—tall, with almost colorless skin, blue or grey eyes, hair from straw color to chestnut, and skulls varying as to proportionate width—are the prevalent inhabitants of Northern Europe, and the type may be traced into North Africa, and eastward as far as Hindostan. On the south and west it mixes with that of the Melanochroi, or dark whites, and on the north and east with that of the Mongoloids.

The Melanochroi, or dark whites, differ from the fair whites in the darkening of the complexion to brownish and olive, and of the eyes and hair to black, while the stature is somewhat lower and the frame lighter. To this class belong a large part of those classed as Kelts, and of the populations of Southern Europe, such as Spaniards, Greeks and Arabs, extending as far as India; while endless intermediate grades between the two white types testify to ages of intermingling. Professor Huxley is disposed to account for the Melanochroi as themselves the result of crossing between the Xanthochroi

and the Australioids. Whatever ground there may be for his view, it is obviously desirable to place them in a class by themselves, distinguishing them by an appropriate name.

A suggestion by Mr. A. R. Wallace has great importance in the application of the development theory to the origin of the various races of man; it is aimed to meet the main difficulty of the monogenist school, how races which have remained comparatively fixed in type during the long period of history, such as the white man and the Negro, should have, in even a far longer period, passed by variation from a common original. Mr. Wallace's view is substantially that the remotely ancient representatives of the human species, being as yet animals too low in mind to have developed those arts of maintenance and social ordinances by which man holds his own against influences from climate and circumstances, were in their then wild state much more plastic than now to external nature; so that "natural selection" and other causes met with but feeble resistance in forming the permanent varieties or races of man, whose complexion and structure will remain fixed in their descendants. (See Wallace, *Contributions to the Theory of Natural Selection*, p. 319.) On the whole, it may be asserted that the doctrine of the unity of mankind now stands on a firmer basis than in previous ages. It would be premature to judge how far the problem of the origin of races may be capable of exact solution; but the experience of the last few years countenances Mr. Drawin's prophecy, that before long the dispute between the monogenists and the polygenists will die a silent and unobserved death.

During the last half century, the fact has been established that human bones and objects of human manufacture occur in such geological relation to the remains of fossil species of elephant, rhinoceros, hyena, bear, &c., as to lead to the distinct inference that man already existed during the ancient period of these now extinct mammals.

This evidence is now generally accepted by geologists as carrying back the existence of man into the period of the post-glacial drift, in what is now called the Quaternary period. That this indicates an antiquity at least of tens of thousands of years may be judged in several ways. The very position in which rude instruments were found showed that they belonged to time quite separate from that of history. Thus, at St. Acheul flint hatchets occur in a gravel-bed immediately overlying the chalk, which bed is covered by some 12 feet of sand and marl, capped by a layer of soil, which is shown by graves of the Gallo-Roman period to have been hardly altered during the last 1500 years.

The interval between the Quarternary or Drift period and the period of historical antiquity is to some extent bridged over by relics of various intermediate civilisations, mostly of the lower grades, and in some cases reaching back to remote dates. The lake dwellings of Switzerland are perhaps among the more recent of these. They were villages of huts built on piles in the water at some distance from the shore, for security from attack—in fact, fortified water settlements of the same nature as those of Lake Prasias in the time of Herodotus, and as those still inhabited in New Guinea and West Africa. The remains of these Swiss villages are found with the stumps of the piles still standing, often embedded in an accumulation of mud or growth of peat which has preserved a kind of illustrative museum of the arts and habits of the lake men. From examination of the sites, it appears that the settlements are of various dates, from the neolithic or polished stone period, when instruments of metal were still unknown, to the time when bronze was introduced, and beyond this into the later age

marked by the use of iron. A few of the lake villages lasted on till the Roman dominion, as is proved by the presence of Roman coins and pottery, but they were soon afterwards abandoned, so that their very existence was forgotten, and their rediscovery only dates from 1853, when the workmen excavating a bed of mud on the shore of the Lake of Zurich found themselves standing among the piles of a lake settlement.

Egypt affords some basis for estimating a minimum date for its ancient population. The hieroglyphic inscriptions, the most ancient written records of the world preserve direct memorials of a time which can hardly be less, and may be much more, than 3,000 years before the Christian era.

The Greeks of the classic period could discuss the Egyptian chronologies with priests and scribes who perpetuated the languages and records of their earliest dynasties; and as the Septuagint translation of the Bible was made at Alexandria, it is not impossible that its giving to man a considerably greater antiquity than that of the Hebrew text may have been due to the influence of the Egyptian chronology. Even if the lowest admissible calculations be taken, this will not invalidate the main fact, that above 4000 years ago the Egyptian nation already stood at a high level of industrial and social culture.

The Chinese dynasties, like those of Egypt, begin with an obviously mythical portion, and continue into actual history; the difficulty is to draw the line where genuine records begin. Those who reckon authentic history only from the dynasty of Chow, beginning about 1100 B.C., during which Confucius lived, will at any rate hardly deny the existence of the earlier dynasty of Shang, previous to which the yet earlier dynasty of Hea is recorded; so that, though much that is related of these periods may be fabulous, it seems certain that there was a Chinese nation and a Chinese civilisation reaching back beyond 2000 B.C.

The teaching of history, during the three to four thousand years to which contemporary chronicles have been preserved, is that civilisation is gradually developed in the course of ages by enlargement and increased precision of knowledge, invention and improvement of arts, and the progression of social and political habits and institutions towards general well-being. The conditions of such races as the older Jews, Greeks, and Germans, are known to us by ancient chronicles, and by poetry and myth even more valuable than chronicle in the details they unconsciously preserve of the state of society at the time whence they have been handed down. Starting from the recorded condition of such barbaric nations, and following the general course of culture into the modern world, all the great processes of mental and social development may be seen at work. Falling back or decay also takes place, but only to a limited extent destroys the results of growth in culture. It is thus matter of actual record, that the ancestors of civilised nations were barbaric tribes, and the inference seems reasonable that the same process of development had gone on during previous ages outside the domain of direct history, so that barbaric culture itself arose out of an earlier and ruder condition of primitive culture, more or less corresponding with the state of modern savage tribes. The failure of direct record of this passage from savagery upward to barbarism was to be expected from the circumstances of the case. No people civilised enough to preserve history could have watched the age-long process of a savage tribe developing its culture; indeed, experience shows that independent progress could hardly have taken place among an uncivilised in contact with a civilised race. Nor could a barbaric nation, though it had really and independently

risen from savagery within some few thousand years, give any valid account of this gradual advancement, for the very reason of its having taken place while the nation was yet in, or but little removed from, the savage state, one part of the very definition of which is that it has no trustworthy means of preserving the history of events even for a single century, much less for the long period required for so vast a development. This view of the low origin and progressive development of civilisation was already held in ancient times, as in the well-known speculations of the Epicurean school on the condition of the earliest men, who roved like wild animals, seeking their food from the uncultured earth, till arts and social laws arose among them, or where the like idea has taken in China the form of ancient legend, recording the time when their nation was taught to use skins for clothing, to make fire, and to dwell in houses. In opposition to such views of primeval rudeness, traditions of a pristine state of human excellence have long been cherished, such as the "golden age." Till of late wide acceptance has been given to arguments, partly based on theological and partly on anthropological grounds, as to man's incapability of rising from a savage state, and the consequent necessity of a supernatural bestowal of culture on the first men, from whose high level savages are supposed by advocates of this theory to have degenerated. The anthropological evidence adduced in support of this doctrine is, however, too weak for citation, and even obviously erroneous arguments have been relied on.

To conclude, the comparative science of civilisation thus not only generalises the data of history, but supplements its information by laying down the lines of development along which the lowest prehistoric culture has gradually risen to the highest modern level. Among the most clearly marked of these lines is that which follows the succession of the stone, bronze, and iron ages. The stone age represents the early condition of mankind in general, and has remained in savage districts up to modern times, while the introduction of metals need not at once supersede the use of the old stone hatchets and arrows, which have often long continued in dwindling survival by the side of the new bronze and even iron ones. The bronze age had its most important place among ancient nations of Asia and Europe, and among them was only succeeded after many centuries by the iron age; while in other districts, such as Polynesia and Central and South Africa, and America (except Mexico and Peru), the native tribes were moved directly from the stone to the iron age without passing through the bronze age at all. Although the three divisions of savage, barbaric, and civilised man do not correspond at all perfectly with the stone, bronze, and iron ages, the classification of civilisation thus introduced by Nilsson and Thomsen has proved a guide of extraordinary value in arranging in their proper order of culture the nations of the Old World. Another great line of progress has been followed by tribes passing from the primitive state of the wild hunter, fisher, and fruit-gatherer to that of the settled tiller of the soil, for to this change of habit may be plainly in great part traced the expansion of industrial arts and the creation of higher social and political institutions. These, again, have followed their proper lines along the course of time. Among such are the immense legal development by which the primitive law of personal vengeance passed gradually away, leaving but a few surviving relics in the modern civilised world, and being replaced by the higher doctrine that crime is an offence against society, to be repressed for the public good. Another vast social change has been that from the patriarchal condition, in which the unit is the family under the despotic rule of its head, to the systems in which individuals make up a society whose

government is centralised in a chief or king. In the growth of systematic civilisation, the art of writing has had an influence so intense, that of all tests to distinguish the barbaric from the civilised state, none is so generally effective as this, whether they have but the failing link with the past which mere memory furnishes, or can have recourse to written records of past history and written constitutions of present order.

ANTHROPOMORPHISM is a term used in theological writings to denote the figure by which words expressing human organs and activities are applied to the divine Being; in short, it is the conception and representation of God as possessed of corporeal and human properties. Originally and literally the world implied only the ascribing to God a physical form resembling the human body, and consequently included under it all forms of expression which attribute to Him the exercise of physical organs and senses. But its meaning was soon extended.

Primitive ideas of God are necessarily framed by man from the analogy of his own nature. He is, however, able to represent God to himself under the analogy of his mental or spiritual, as well as under that of his material nature. This more refined form was called anthropopathism, and is that mode of contemplating the divine attributes founded on the analogy of God to the human spirit. All forms of expression which ascribe to God passions, intelligence, or volition, rest ultimately upon this supposed analogy. In modern theology and philosophy, it is this mode of thought that usually receives the name of anthropomorphism.

The church itself was not free from anthropomorphism of the crudest type. In the 2d century Melito, bishop of Sardis, wrote a book concerning the corporeity of God; and in the 4th century Audæus, in Mesopotamia, held similar views, and had many followers. In the Middle Ages the question gradually merged into the more philosophical one of the relation between reason and faith. In modern theology the problem again appears, but its aspect is completely philosophical. Philosophy, indeed, has never ceased to concern itself with this very question. Xenophanes mocked the anthropomorphism of his countrymen; Aristotle denied to the gods ethical virtue and the possession of emotions or passions; he allowed to them only a life of intellectual speculation. Spinoza is one of the strongest opponents of any form of anthropomorphism, and from him the modern aspect of the question may be said to proceed. He brought clearly to light the fundamental difficulty, the reconciliation of the infinite and absolute nature of God with any attribute whatsoever; for attribute, as such, implies negation, *i. e.*, limitation. Spinoza dismisses as anthropomorphic the idea of God as an intelligence, as free to act, and as ruling the world, and thus destroys the ideas of design in nature and providence. The consequences of this theory on questions relating to the personality of God, miracles, prayer, &c., have been worked out very fully in the most recent times.

ANTIBES, a seaport town of France, on the Mediterranean, in the arrondissement of Grasse, which formerly belonged to the department of Var, but which was transferred to the new department of Alps Maritimes in 1860. Population about 6,000.

ANTICHRIST. The word occurs only in the first and second epistles of John. It signifies an opponent or adversary of Christ. The idea expressed by it had its origin in Judaism. According to prophetic anticipations, the Messianic time was to be immediately preceded by a great conflict, in which Jehovah would fight out of Zion for His own people, and defeat the concentrated opposition of the world. An Almighty leader on

the one side seemed to require an antagonist on the other, a head of the army of darkness against the Prince of Light.

St. Paul resumes the idea of antichrist. Whatever Jewish conceptions he laid aside, and he emancipated himself from most of them, he did not abandon the idea of antichrist or terrible adversary of the true religion.

The author of the Revelation presents the antichrist idea in a more definite form than St. Paul. Borrowing characteristic traits from Antiochus Epiphanes, perhaps too from Caligula, whose blasphemous order to set up his own image in the attitude of Olympian Zeus within the holy temple at Jerusalem created intense excitement throughout Palestine, aware of the fearful persecution which the Christians had suffered from Claudius' successor on the throne of the Cæsars, the apostle John makes the man of sin or antichrist to be Nero returning from the East, according to a report then current.

During the Middle Ages, and those which immediately followed, current opinion discovered antichrist in heretics and sects.

As the corruption of the Romish Church increased, and the necessity of reform became more apparent, anti-ecclesiastical thought found antichrist in the Papacy; and that again naturally provoked the church to characterize all heretics as the collective antichrist. The Church of Rome led the way in misapplying the Apocalypse during her contest with civil powers and heretics; her opponents followed the example in turning the instrument against herself. Antichristianism could be embodied in the Papacy as well as in heretical doctrine outside it. Accordingly, the Waldenses, Wicliffe, Huss, and others, found antichrist in the Pope.

ANTICLINE, in rhetoric, is an abrupt declension on the part of a speaker or writer from the dignity of idea which he has attained, as in the following well-known distich:—

"The great Dalhousie, he, the god of war,
Lieutenant-colonel to the earl of Mar."

ANTICLINE (Gr. *anti*, "against," and *kline*, "I bend"), in geology applied to strata which are inclined in opposite directions from a common axis. *Saddle-back* is the miners' term. Syncline is the converse of anticline and is applied to strata which are inclined in opposite directions toward a common axis.

ANTICOSTI, a barren island of British North America, situated in the Gulf of St. Lawrence.

ANTICYRA, in Ancient Geography, the name of three cities of Greece. (1.) In Phocis, on the Bay of Anticyra, in the Corinthian Gulf. Its modern name is Aspra Spitia, where some remains are still visible. It was a town of considerable importance in ancient times; was destroyed by Philip of Macedon; recovered its prosperity; and was captured by Flaminius in 198 B.C. (2.) In Thessaly, on the right bank of the River Sperchius, near its mouth. (3.) In Locris, on the left side of the entrance to the Corinthian Gulf, not far from Naupactus.

ANTIETAM, a small river of the United States, which rises in Pennsylvania, and, flowing into Maryland, joins the Potomac about fifty miles from Washington. An indecisive battle between the Federals under McClellan and the Confederates under Lee was fought on its banks on September 16-17, 1862. At the close of the Pennsylvania campaign, as will be remembered, the army of the Potomac was consolidated with the army of Virginia, and General John Pope was made commander-in-chief. McClellan had been removed, and the succeeding campaigns of that summer in Virginia terminated with the defeat of Pope at the second battle of Bull Run. This event was followed by Pope's resignation, McClellan was recalled, and on September 5, 1862, Lee's army crossed the Potomac river in pursu-

ance of the plan of its commander "to transfer the scene of operations to the enemy's territory." The campaign in Maryland was inaugurated at Frederick and included among its leading features the surrender of Harper's Ferry with a force of 11,000 men.

McClellan, who had meanwhile been moving in pursuit of the enemy, came up with D. H. Hill's division at Boonsboro Pass, September 14. An engagement followed, but without material advantage to either side. That same night Lee reached Sharpsburg, and two days later the opposing armies confronted one another on opposite banks of Antietam creek, a stream of minor importance flowing through a beautiful expanse of country and emptying into the Potomac river ten miles from Harper's Ferry. The creek opposite Sharpsburg is fordable, and at the date of the battle was crossed by three stone bridges. On the night of September 16 the contending forces were placed in position, the right of the Union army being held by the divisions of Hooker and Mansfield, supported by the divisions of Sumner and Franklin, with Burnside on the left and Fitz-John Porter's command occupying the center. The Confederate army was commanded by General Lee in person, the right, center and left being severally held by the divisions of Longstreet, D. H. Hill and Hood. They were arranged in order of battle on Antietam heights, elevations ascending almost abruptly from Antietam creek between the latter and the Potomac river, and affording advantages of no inconsiderable importance. The battle was commenced at daylight on the morning of September 17, Hooker and Mansfield attacking Hood's division and compelling the latter's temporary retirement. The enemy were reinforced, however, and in time caused the retreat of Hooker, the battle so continuing with varying fortune throughout the day, the left doing comparatively little execution, the dislodgement of the Confederates from their position being found to be impossible. The Union lines were equally impregnable; all attempts to divide the army were vain, the Confederates each time the attempt was made being repulsed with disastrous results. The contest was prolonged until late in the afternoon when a suspension of hostilities occurred, each army undertaking preparations for active operations on the succeeding day. The battle, however, was not resumed on the 18th, and that night Lee withdrew, re-crossing the Potomac on the 19th, and marched to Winchester. The same day McClellan began the pursuit of the Confederates, but proceeded no further than Warrenton.

The battle of Sharpsburg or Antietam has been variously regarded as indecisive, and as a decided success for the Union army. Both sides lost heavily, between thirteen and fourteen thousand men having fallen on either side, including General Mansfield, of the Union army; and many of the officers were seriously wounded, General Jo. Hooker among the number.

ANTI-FEBRIN, a white powder insoluble in cold water, but readily soluble in alcohol, is used as a febrifuge instead of quinine. It is derived from anilin.

ANTIGONE, the daughter of Œdipus, known in Greek legend, first, for the faithfulness with which she attended her father when he, on discovering that Jocaste, the mother of his children, was also his own mother, put his eyes out and resigned the throne of Thebes; secondly, for having, in defiance of a decree, buried with due rites the body of her brother Polyneics, for which act she was sentenced to be buried alive in a vault.

ANTIGONE (2), in Greek legend, the daughter of Eurytion, king of Phthia, who gave her in marriage to Peleus, the issue being a daughter, Polydora. Peleus having accidentally killed Eurytion in a hunt, some say the hunt of the Calydonian boar, fled and obtained ex-

piation from Acastus, whose wife in malice, because her affection for Peleus was not returned, informed Antigone that it was, upon which Antigone took her own life.

ANTIGONUS I., called *Cyclops*, from his having lost an eye, one of the generals of Alexander the Great, was the son of Philip of Elymiotis. In the division of the provinces after Alexander's death, 323 B.C., Pamphylia, Lycia, and Phrygia Major fell to his share. But Perdiccas, having an eye to universal dominion, determined to divest him of his government, and laid plans for his life, by bringing various accusations against him. Antigonus escaped with his son Demetrius into Greece, where he obtained the favor and protection of Antipater, 321 B.C.; and when soon after, on the death of Perdiccas, a new division took place, he had the province of Susiana added to his former share. He was likewise intrusted with the command of the war against Eumenes, who had joined Perdiccas against the coalition of Antipater, Antigonus, and the other generals. Eumenes was thoroughly defeated, and was obliged to retire with only 600 men to the inaccessible castle of Nora, and a new army that was marching to his relief was also routed by Antigonus. In the interval Antipater had died (318 B.C.), and the opportunity excited the ambition of Antigonus to possess the whole of Alexander's empire. Polysperchon succeeding Antipater in the regency, to the exclusion of Cassander his son, Antigonus resolved to set himself up as lord of all Asia. On account of the great power of Eumenes, he greatly desired to gain him over in his interest; but that faithful commander, effecting his escape from Nora, raised an army, and was appointed the royal general in Asia. He defeated Antigonus in several engagements, but was at last delivered up to him through treachery, and put to death. Upon this the governor of Upper Asia yielded to Antigonus. The latter now seized upon all the treasures at Susa, and directed his march towards Babylon, of which Seleucus was governor. Seleucus fled to Ptolemy, and entered into a league with him, together with Lysimachus and Cassander, in order to check the exorbitant power of Antigonus (315 B.C.) Notwithstanding this Antigonus made a successful attempt upon Syria and Phœnicia, though these provinces were soon after recovered by Ptolemy, who defeated his son Demetrius, while he himself was employed against Cassander in Asia Minor. They were again taken by Antigonus, who, flushed with success, sent an expedition against the Nabathæan Arabs dwelling in the deserts adjacent to Judæa. In the first enterprise his troops were cut to pieces by the Arabs; but his son commanded the second, and was more successful. Demetrius then expelled Seleucus from Babylon; and, success attending his arms wherever he went, the confederates had to make a treaty with Antigonus, stipulating that he should remain in possession of all Asia, but that the Greek cities should retain their liberty. This agreement was soon violated, under the pretense that garrisons had been placed in some of these cities by Antigonus. At first Ptolemy made a successful descent into Asia Minor, and on several of the islands of the Archipelago; but he was at length totally defeated by Demetrius, in a naval engagement off Salamis, in the island of Cyprus. On gaining this victory Antigonus assumed the title of king, and bestowed the same upon his son; and from that time (306 B.C.) his reign in Asia, and that of Ptolemy in Egypt, and of the other generals of Alexander in their respective provinces, properly commence. Antigonus now prepared a large army, and a formidable fleet, the command of which he gave to Demetrius, and hastened to attack Ptolemy in his own dominions. His invasion of Egypt, however, proved a failure; a battle with

Ptolemy at Mount Casius gained Antigonus no advantage, and after a few other fruitless efforts, he was obliged to retire, (306 B.C.) Demetrius attempted the reduction of Rhodes; but, meeting with obstinate resistance, he was obliged to make a treaty upon the best terms he could, in order to join his father in crushing a confederacy that had been formed between Cassander, Seleucus, and Lysimachus. Father and son advanced with their united forces into Phrygia, and met the enemy at Ipsus. A decisive battle was fought, in which Antigonus fell, in the 81st year of his age, 301 B.C., and with him fell the fortunes of his house.

ANTIGONUS (GONATAS), son of Demetrius Poliorcetes, and grandson of the former Antigonus, was born at Gouni in Thessaly about 319 B.C. On the death of his father in Asia, 283 B.C., he assumed the title of king of Macedonia, but did not obtain possession of the throne till 277, after it had been successively in the hands of Pyrrhus, Lysimachus, Seleucus, and Ptolemy Ceraunus. Antigonus repelled the invasion of the Gauls, and continued in undisputed possession of Macedonia till 273, when Pyrrhus returned from Italy and dethroned him. Pyrrhus fell, 272 B.C., at Argos, and Antigonus was again restored to power. The latter part of his reign was comparatively peaceful, and he gained the affection of his subjects by his mildness of disposition and his cultivation of arts. He resisted the formation of the Achæan league, but did not resort to arms to enforce his opposition. He died, leaving his kingdom in peace, in the 80th year of his age, and the 44th of his reign, 239 B.C.

ANTIGUA, one of the West Indian Islands, in the British Leeward group, situated 50 miles E. of St. Christopher, with an area of 108 square miles, and a circumference of about fifty miles. Population about 20,000.

ANTILEGOMENA (contradicted or disputed), an epithet applied to the early Christian writers to denote those books of the New Testament which, although sometimes publicly read in the churches, were not for a considerable time admitted to be genuine, or received into the canon of Scripture. These books are so denominated in contradistinction to the *Homologoumena*, or universally acknowledged writings.

ANTILLES, a name that is usually, although by no means uniformly, applied to the whole of the West Indian Islands, with the exception of the Bahamas; it has also, on the one hand, been employed to designate smaller portions of the same group, and, on the other, it has been extended so as to comprehend the whole archipelago, inclusive of the Bahamas. The traditional derivation of the word Antilles itself, from Antilla, a continent supposed to lie to the west of the Azores, and for which Cuba, or some other West Indian island, was mistaken, is too doubtful and too vague in its application to be of any value in determining the proper use of the term; the weight of authority seems to be in favor of the first acceptance. In this sense the Antilles have been divided into two groups:—the Greater Antilles, including Cuba, Jamaica, Hayti, and Porto Rico; and the Lesser Antilles, forming the remainder of the islands. See WEST INDIES.

ANTIMACHUS, the Colophonian, a Greek poet who was honored by the Alexandrine grammarians with the second place in their epic canon. Of his works nothing remains to us but the merest fragments; and of his life, we know little more than that he was born at Claros; was beaten by a rival in poetical competition at Samos; met, either then or in equally discouraging circumstances with Plato; fell in love with a lady called Lyde; lost her by death; bewailed her in an elegy of extreme erudition, if not of extraordinary pathos; and celebrated in his epic the seven heroes of Thebes.

ANTIMONY, a metal found native to a small extent in many of the localities from which its ores are derived. It has been obtained at Sahlberg, near Sahl in Sweden, at Andreasberg in the Harz, at Allemont in Dauphiny, Przibram in Bohemia, besides being brought from Borneo, Chili, Mexico, New Brunswick, &c. It also occurs in nature alloyed with other metals; allemontite being arsenical antimony; dyscrasite, antimonial silver; and breithauptite, a native alloy of antimony and nickel. Among the ores of antimony may be enumerated valentinite, or white antimony; and cervantite, or antimony ochre, both oxides of antimony and kermesite, red antimony, or antimony blende, or oxysulphide of the metal. Various sulph-antimonites of other metals are also met with, but they possess only a mineralogical interest. The antimony of commerce is derived almost entirely from the sulphide, stibnite, or grey antimony ore, which is found in great abundance in Borneo, in Nevada, and at Prince William antimony mine, New Brunswick. It is also mined at Schemnitz and Kremnitz in Hungary, at Przibram in Bohemia, at Wolfsberg in the Harz, and at Braunsdorf near Freiberg, Bavaria. Crude antimony sulphide is used in the manufacture of black lead pencils. For the action of antimony as a poison, see POISONS.

ANTINOMIANS, a term first employed by Luther as a designation of the followers of John Agricola, who maintained that the moral law was not binding, as such, upon Christians (see AGRICOLA, JOHANNES). In this, as in many other cases, however, the thing existed long before the name.

ANTINOMY is the word employed by Kant, in the Critical Philosophy, to mark the inevitable conflict or contradiction into which, according to his view, speculative reason falls with itself, when it seeks to conceive the complex of external phenomena, or nature, as a world or cosmos. Literally the word means a conflict or opposition of laws. It is used by Kant both in a generic and in a specific sense; the fate that lies upon the speculative endeavor of human reason taking the form of four special contradictions. For the generic sense Kant also has the word Antithetic, each antinomy being set forth in the shape of thesis and antithesis, with corresponding demonstrations, the perfect validity of which, in all cases, he most positively guarantees. The conflicting propositions, or the cosmological ideas involved in them, are intimately, though somewhat obscurely, related to the four heads of categories of the understanding in the Kantian system, but this is not the place to enter into such details.

ANTINOUS, a beautiful youth, who was page to the emperor Hadrian, and greatly beloved by him. After his mysterious death by drowning in the Nile (130 A. D.), Hadrian—for whose sake, according to one account, he had offered himself a voluntary victim to destiny—caused the most extravagant respect to be paid to his memory by ceremony and monument.

ANTIOCH, a city in Syria, described as "Epidaphnes," or as "on the Orontes," to distinguish it from the fifteen other Greek towns which, like itself, owed their foundation to Seleucus Nicator, and their names to his father Antiochus. While the widespread notoriety of Daphne, with its beautiful grove, compared to the vale of Tempe, and with its extraordinary excesses of pleasure, rendered it available as a local designation for Antioch, the river Orontes also seems to have served the same purpose with more than usual interest, owing perhaps, to its fabulous history. Originally it had been called Typhon, from the snake-legged giant of that name (Strabo, p. 750), who here struck by the thunderbolt of Jupiter, and seeking escape under the earth, formed the bed of the river by his trail, and its source

by his descent. Orontes, it was said, was the name of a man who had built a bridge over the river, and when in Roman times the course of the stream was partly changed, a tomb (*soros*) was found in the old bed containing the bones of a man of colossal size, which the oracle declared to be those of Orontes. On the coins of Antioch struck by Tigranes, and frequently on those of later times, the city is personified as a female figure seated on a high rock or hill, from under which issues the Orontes in the form of a youth in the attitude of swimming. The same representation occurs in a marble statue in the Vatican, and in a silver statuette in the British Museum; and in each case there can be little doubt that the original model was the celebrated statue of Antioch by Eutychides, a sculptor of Lysippus.

On the dismemberment of the Eastern empire founded by Alexander the Great, it fell to Seleucus to make himself master of that portion of it included in Syria. It was an age remarkable for the building of new towns more or less on the plan of Alexandria, and accordingly Seleucus, instead of establishing himself at Antiochia, the newly-built capital of his defeated rival, chose a site a little further down the Orontes, about 20 miles from its mouth, for the capital of his new kingdom, the task of laying out and building it being entrusted to the architect Xenæus. On Mount Silpius was placed the citadel, and on the slope towards the river the town. Seleucus destroyed Antiochia, transferred its inhabitants to Antioch, and perhaps, as has been said, utilized its building material. In addition to this new population there were the old inhabitants of the village of Iopolis or Ione, which had before occupied the citadel, and which traced its origin to Ione, an Argive fugitive from Egypt, in search of whom Triptolemus had been sent from Eleusis. Though this legend appears to have originated simply from the name Ione, the people of Antioch yet boasted of a common descent with the inhabitants of Attica, struck coins with the head of Pallas and an owl, precisely like coins of Athens, and maintained the traditions of Triptolemus as of a sort of ancestral hero. Besides Iopolis, the villages of Meroe, afterwards a suburb, and Bottia, on the banks of the Orontes, where Alexander dedicated a temple to Jupiter Bottiæus, claimed to have furnished the original inhabitants of Antioch. But the town founded by Seleucus, 300 B. C., soon became insufficient for the influx of population, and a new district had to be enclosed, the original walls being allowed to remain. For the same purpose a third addition was made in the time of Seleucus Callinicus (246–226 B. C.), and a fourth under Antiochus Epiphanes (175–164 B. C.), to whom the city owed also many new buildings of great splendor. From its four parts, each separately walled, Antioch was now called a *tetrapolis*, and in point of situation, architectural magnificence, and resources of enjoyment, ranked after Rome and Alexandria as the next city of its time.

ANTIOCH IN PISIDIA, another of the many cities founded by Seleucus Nicator, was situated on the south side of the range of mountains between Phrygia and Pisidia. Its remains, which were identified by Arundel in 1833, are close to the modern Yalobatch, and include the ruins of several temples, a theatre and a magnificent aqueduct.

ANTIOCHUS I. (SOTER, the Deliverer) succeeded his father Seleucus Nicator, the founder of the Syrian kingdom, in 280 B. C. He maintained for a time his father's Macedonian policy, but at length came to terms with Antigonus Gonatas. Successful at first against the Gauls, who had invaded Asia Minor, he was finally slain by them in battle (261 B. C.).

ANTIOCHUS II. (THEOS, the God), the son and successor of Antiochus I. Under him Syria was troubled

with a long Egyptian war, and lost Parthia and Bactria, which became independent. He was forced by Ptolemy of Egypt to put away his wife and marry an Egyptian princess, Berenice; but on Ptolemy's death Berenice was discarded, and Laodice restored. The latter, however, out of revenge or mistrust procured the death of her husband, her rival, and their son, 246 B.C.

ANTIOCHUS III., surnamed the Great, was the son of Seleucus Callinicus, and ascended the Syrian throne at the age of fifteen, on the death of his brother, Seleucus Ceraunus. His reign embraced a series of wars against the revolted provinces and neighboring kingdoms, in the prosecution of which his disasters and successes were equally great. His march to India; his agreement with Philip of Macedonia for the partition of Egypt; his conquest of Palestine and Cœle-Syria; his occupation of Asia Minor and the Thracian Chersonese; his collision with the Romans; his expedition into Greece, with the defeat at Thermopylæ by Acilius Glabrio, and at Mount Sipylus (in Asia Minor) by Scipio; and his dearly purchased peace in 188 B.C., are the chief events of his life. He was killed in an attempt to plunder a temple at Elymais, 187 B.C., and was succeeded by his son Seleucus Philopator.

ANTIOCHUS IV., (EPIPHANES, the Illustrious, and by parody, EPIMANES, the Insane), who had been a hostage in Rome from 187 B.C., ascended the Syrian throne on the death of Seleucus, 175 B.C., and soon made himself famous by his conquest of Cœle-Syria, Palestine, and Egypt itself, with the exception of Alexandria, which would likely have also been his if the Romans had not interfered and forbidden him the country. During his Egyptian campaigns he twice took Jerusalem (170 and 168 B.C.); but he appears to have seen that he could never hope to subdue Judæa until he had rooted out the peculiar Jewish religion. He accordingly promulgated a decree, enjoining uniformity of worship throughout his dominions; and on the refusal of the Jews to obey it, he went in person to Jerusalem and endeavored to force on them the worship of the Greek deities. This persecuting policy stirred up the resistance of the Maccabees; and it was while hastening to quell this revolt that he fell ill of a loathsome disease, and died, raving mad, at Tabæ, in Persia, 164 B.C. His death was thought by the Jews to be an appropriate punishment for his persecution of them.

ANTIOCHUS VIII., king of Syria, was the second son of Demetrius Nicator. During his reign (125-96 B.C.) those discords and wars began between the princes of the royal house of Syria, which form almost its sole history, till the kingdom was reduced to a Roman colony in 65 B.C.

ANTIOCHUS, OF ASCALON, a philosopher of the 1st century before Christ, who, coming under the influence of Philo the Academic and of Mnesarchus the Stoic, was led to attempt a reconciliation between their antagonistic doctrines, and thus gave rise to what has been called the Fifth Academy. In regard to the great question of the degree of certainty attainable by man, he held, in opposition to the scepticism of Philo, that the human intellect has in itself a sufficient test of truth; and in regard to the question wherein happiness consists, he maintained that, while virtue was the greatest essential, the circumstances of life were not a matter of indifference. Of his writings none have been preserved to us; and for the greater part of our information we are indebted to Cicero, who had studied under him at Athens, and continued to keep up a friendly intercourse with him afterwards. He visited Alexandria and Rome, and lectured on philosophy in both cities.

ANTIOPE (1), in Greek legend, the mother of Amphion and Zethus, was, according to the *Odyssey*, a

daughter of the river god Asopus. In later poems, as in the *Cypria*, she is described as the daughter of Lycurgus, who appears as a king of Thebes. Her beauty attracted Jupiter, who, assuming the form of a satyr, took her by force. After this she was carried off by Epopeus, king of Sicyon, who would not yield his possession of her till compelled by his uncle Lycus. On the way home she gave birth, in the neighborhood of Eleuthera, to the twins Amphion and Zethus, of whom the former, some supposed, was the son of the god, the other the son of Epopeus. Both were left to be brought up by herdsmen. At Thebes Antiope now suffered from the persecution of Dirce, the wife of Lycus, but at last escaped toward Eleuthera, and there found shelter, unknowingly, in the house where her two sons were living as herdsmen. Here she was discovered by Dirce, who ordered the two young men to tie her to the horns of a wild bull. They were about to obey, when the old herdsman, who had brought them up, revealed his secret, and they now carried out the punishment on Dirce instead. For this, it is said, Bacchus, to whose worship Dirce had been devoted, visited Antiope with madness, which caused her to wander restlessly all over Greece till she was cured, and thereafter married by Phocus of Tithorea, on Mount Parnassus, where at last both were buried.

ANTIOPE (2), an Amazon who bore to Theseus a son, Hippolytus. As to how Theseus became possessed of her there are various reports. Either she gave herself up to him out of love, when with Hercules he captured Themiscyra, the seat of the Amazons, or she fell to his lot then as a captive.

ANTIPAROS, the ancient *Oliaros*, an island of the kingdom of Greece, one of the Cyclades, in the modern eparchy of Naxos, situated on the west of Paros, from which it is separated by a strait about a mile and a half wide at the narrowest point.

ANTIPAS, HEROD. See HEROD ANTIPAS.

ANTIPATER, regent of Macedonia during Alexander's Eastern expedition, 334 B.C. He gained his distinguished position by his faithful attachment and his prudence. In 330 he had to subdue the rebellious tribes of Thrace; but even before this insurrection was quelled, the Spartan king Agis had risen against Macedonia. Having settled affairs in Thrace as well as he could, Antipater hastened to the south, and in a battle near Megalopolis, gained a complete victory over the insurgents. In the first partition of Alexander the Great's empire among the Macedonian generals, Antipater and Craterus had allotted to them the administration of the dominions in Europe with the exception of Thrace, which was given to Lysimachus. The death of Alexander tempted the Greeks to assert their independence, but the prudence and valor of Antipater crushed all attempts in the Lamian war, and established the Macedonian rule in Greece on a firm footing. At the same time Craterus was engaged in a war against the Ætolians, when news arrived from Asia which induced Antipater to conclude peace with them; for Antigonus reported that Perdicas contemplated making himself sole master of the empire. Antipater and Craterus accordingly prepared for war against Perdicas, and allied themselves with Ptolemy the governor of Egypt. Antipater crossed over into Asia in 321; and while still in Syria, he received information that Perdicas had been murdered by his own soldiers. Antipater now, as sole regent, made several new regulations, and having commissioned Antigonus to continue the war against Eumenes and other partisans of Perdicas, returned to Macedonia, where he arrived in 320. Soon after he was seized by an illness which terminated his active career 319 B.C. Passing over his son Cassander, he

appointed Polysperchon regent, a measure which gave rise to much confusion and illfeeling.

ANTI-PERIODICS, drugs which relieve or cure certain diseases (particularly ague and some forms of neuralgia and headache), the attacks of which occur at regular intervals. The most important are cinchona bark and its alkaloids, and arsenic.

ANTIPHLOGISTIC, remedies and regimen opposed to inflammation, such as blood-letting, purgatives, and low diet.

ANTIPHILUS, a painter of the 4th century before Christ, who was placed by the ancient critics in the highest rank after Apelles and Protogenes.

ANTIPHON, the most ancient of the ten Athenian orators contained in the Alexandrine canon. He was born 480 B.C. at Rhamnus. During the Peloponnesian war he was several times entrusted with the command of detachments of the Athenian forces, and took an active part in the political affairs of Athens. He had a hand in the overthrow of the democracy, and the establishment of the oligarchy of the Four Hundred, 411 B.C.; but as the new government was soon after changed, Antiphon was accused of high treason, and put to death.

ANTIPHONY, a species of psalmody in which the choir or congregation, being divided into two parts, sing alternately. The peculiar structure of the Hebrew psalms renders it probable that the antiphonal method originated in the service of the ancient Jewish Church.

ANTIPODES, a word of Greek derivation (against, opposed to feet),—from the inhabitants walking feet to feet,—is a relative term applied to any two peoples or places on opposite sides of the earth, so situated that a line drawn from the one to the other passes through the centre of the globe and forms a true diameter. Thus, the North Pole is exactly antipodal to the South. Noon at the one place is midnight at the other, the longest day corresponds to the shortest, and mid-winter is contemporaneous with mid-summer. In the calculation of days and nights, midnight on the one side may be regarded as corresponding to the noon either of the *previous* or of the *following* day. If a voyager sail eastward, and thus anticipate the sun, his dating will be twelve hours in advance, while the reckoning of another who has been sailing westward will be as much in arrear. There will thus be a difference of twenty-four hours between the two. In this way the Portuguese in Macao are a day before their Spanish neighbors in the Philippine Islands.

ANTI-POPE, the popes elected in opposition to those canonically chosen. Difficulties as to the choice of popes occurred in the fourth and fifth centuries, and during the Middle Ages the emperors of Germany several times set up a rival pope. In the fourteenth century the unseemly spectacle of a divided church, with one pope reigning at Rome and another at Geneva or Avignon, scandalized Christendom for seventy years. See **POPEDOM**, page 483 *et seq.*, and **ROME**, pages 5120 to 5126.

ANTI-PYRENE, a valuable febrifuge obtained from coal-tar. It has lately been much used in treatment of headaches arising from congestion, administered in doses of from 5 to 25 grs. Its habitual use is greatly to be reprobated, as it is dangerous in a layman's hands, and it should not be given in combination with any of the compounds of nitrous acid, as the result is a virulent poison.

ANTIQUÉ, denoting etymologically anything that is ancient, is conventionally restricted to the remains of Greek and Roman art, such as sculptures, gems, &c.

ANTIQUITIES. In keeping with its derivation the word "antiquities" had for long a wide and general acceptance, embracing everything belonging to the

knowledge of the remoter past. The range of the term has been gradually lessened, and a distinction has grown up between history on the one hand and antiquities on the other, though the line of demarcation is not of the most definite kind.

At the revival of learning, when such enthusiasm was felt for everything classical, the relics of Greece and Rome were carefully collected and preserved; but it was some time before a transition took place from classical to national antiquarianism; and hence it is that the earliest literature or archæology is almost solely confined to the classical area.

ANTI-RENTISM, a popular movement in the state of New York 1843-47, when the tenants of land refused to pay rent to the "patroons" who claimed title under old Dutch grants. The agitation led to considerable trouble and rioting, and finally the feudal tenures were abolished by the legislature.

ANTI-SEMITES, the opponents of the Jews in Russia, Germany, Hungary, and Roumania. Both in Russia and Hungary the Hebrews were brutally persecuted (1881-84), and an Anti-Semitic league was formed in Germany in 1881. The movement led to the emigration of many thousand Jews, and the *Judenhetze* has not even yet spent its baleful force.

ANTISEPTICS, substances which have the property of preventing or arresting putrefaction in dead animal or vegetable matter. The access of air, together with a moderate amount of warmth and of moisture, are necessary to the occurrence of the putrefactive changes, which consist essentially in the breaking up of the complex organic material, and the formation of new and simpler combinations among its constituent elements. During the process various gases and vapors are evolved, and the lower forms of animal and vegetable life are observed to grow and multiply in the putrefying substance.

Putrefaction may be prevented by removing one or more of the conditions essential to its occurrence. Thus, by exclusion of the atmosphere, dead matter, which would speedily undergo decomposition, may be kept intact for an indefinite length of time, as shown in the method of preserving meat by hermetically sealing the jars after the expulsion of the air by the heat. Again, the preservative influence of a low temperature is well known; and extreme cold is a powerful antiseptic, as proved in case of the frozen mammoths of northern Asia. Quinine has been found to possess strong antiseptic properties. The tar products, notably carbolic acid, are among the most approved and extensively used of all antiseptic agents. One of the most important applications of antiseptics has been their introduction into medical and surgical practice. Although their internal administration, with the view of counteracting diseases believed to be due to morbid poisons, has not hitherto yielded any marked practical result, their employment in the treatment of wounds has attracted much interest, and has exercised an important influence on surgical practice during late years, Iodoform, specially, being largely used.

ANTISTHENES was the earliest Greek expositor of a philosophy and mode of life to which the name of Cynicism soon came to be applied. Though a native of Athens, he was the son of a Thracian mother; and it was in the gymnasium of Cynosarges, to which the half-breeds were restricted, that he is said to have taught. From that place he and his followers probably received the name cynic; but the popular derivation of the word connected it with the dog, whose shamelessness and importunity many of their actions seemed to imitate. In the time of Diogenes the name was firmly fixed as a nickname, and even adopted by the Cynics themselves.

Antisthenes was apparently born some years before the Peloponnesian war began.

The great age of Cynicism in Greece is the century from 400 to 300 B. C. Then for more than three centuries the name continued a tradition, when in the 1st and 2d centuries of the Christian era it was revived. The majority of the Cynics of that date were a worthless set of vagabonds, who used the garb and the name as a cover for all iniquities. They may be compared to the mendicant orders, in the worst days of their corruption. But amongst them two or three names have a brighter light thrown upon them. Demetrius is lauded by his contemporary Seneca, and about a hundred years later Democritus is enthusiastically presented to the world by Lucian.

ANTITHESIS (*ἀντίθεσις*) is, in rhetoric, the bringing out of a contrast in the meaning by an obvious contrast in the expression, as in the following:—"When there is need of silence, you speak, and when there is need of speech, you are dumb; when present, you wish to be absent, and when absent you desire to be present; in peace you are for war, and in war you long for peace; in council you descant on bravery, and in the battle you tremble."

ANTITYPE (*ἀντίτυπος*) denotes a type or figure corresponding to some other type. It is in the sense of *copy* or *likeness* that the word occurs in the New Testament (Heb. ix. 24; 1 Peter iii. 21). By the fathers of the Greek Church antitype is employed as a designation of the bread and wine in the sacrament of the Lord's supper.

ANTIUM, a city on the Italian coast, about 33 miles S. from Rome. Its site is now occupied by the village *Porto d'Anzio* or *d'Anzo*. Founded, it is supposed, by Pelasgians, it became connected with the Latin League, and about the beginning of the 4th century before Christ passed into the hands of the Volsci. As the chief city of this people, it continued, in spite of repeated defeat, to carry on, with intervals of peace, a pertinacious war against the Romans till the year 338 B. C., when it was finally subdued, and garrisoned by a Roman colony, its ships being destroyed, and their *rostra* or beaks sent to ornament the speaker's platform in the Forum. Towards the close of the republic it was again a beautiful and flourishing town, greatly resorted to by the wealthier Romans. It is now the property of the Borghese family, and is a favorite bathing-place in the early summer months.

ANTIVARI, or BAR, a town of Turkey, in Albania, situated on the Adriatic Sea, eighteen miles northwest of Scutari. Population about 3,000.

ANTLERS, bony outgrowths from the frontal bones of almost all the members of the deer family, but, except in the reindeer, restricted to the males. Most species of deer shed their antlers annually at the close of the breeding season, and each year the new growth attains a larger size, with more "tines," or branches, than that of the preceding season.

ANT-LION, the larva of an insect (*Myrmecoleon*) of the order *Neuroptera*, remarkable for its skill in capturing ants. The insect, or rather the larva, excavates a funnel-shaped pitfall in the sandy ground and lies in wait at the bottom until the ants fall into the hole, when they are speedily devoured.

ANTOMMARCHI, FRANCESCO, born in Corsica in 1780; died in Cuba, April 3, 1838. In 1818 he went to St. Helena as physician to Napoleon, who, at his death, left Antommarchi a legacy. Antommarchi published, in 1823, *The Last Moments of Napoleon*.

ANTONELLI, GIACOMO, born in the Papal States, April 2, 1806; died November 6, 1876. He was the son of a woodcutter, became a priest and gained the favor of Gregory XVI., under whom he was minister of finance. Pius IX. made him a cardinal deacon in 1847, and for the remainder of his life he was the leading

counselor of that pontiff. A woman claiming to be his natural daughter, laid claim to his estate, of \$8,000,000, but was defeated in the lawsuit which she brought.

ANTONELLO DA MESSINA. Of the events of this celebrated painter's life we know little more than that he was probably born at Messina about the beginning of the 15th century; lived and labored at his art for some time in his native country; happening to see at Naples a painting in oil by Jan Van Eyck, belonging to Alfonso of Aragon, was struck by the peculiarity and value of the new method; set out for the Netherlands to acquire a knowledge of the process from Van Eyck's disciples; spent some time there in the prosecution of his art; returned with his secret to Messina about 1465; probably visited Milan; removed to Venice in 1472, where he painted for the Council of Ten; and died there about 1493.

ANTONIDES, HANS [JAN VAN DER GOES], a Dutch poet, was born April 3, 1647, at Goes, in Zealand, of poor but respectable parents. They removed to Amsterdam when he was about four years old, and he there enjoyed the tuition of Hadrian Junius and James Cocceius. His parents designed him for an apothecary; but Buisdro, one of the lords of the admiralty at Amsterdam, defrayed his college expenses, and enabled him to take the degree of doctor of physic. His writings are remarkable for their warmth of fancy and vigor of expression, which sometimes degenerate into extravagance and bombast. His complete works were printed at Amsterdam in 1714, 4to, with a sketch of his life.

ANTONINI ITINERARIUM, a valuable register, still extant, of the stations and distances along the various roads of the Roman empire, seemingly based on official documents, which were probably those of the survey organized by Julius Cæsar, and carried out under Augustus.

ANTONINUS LIBERALIS, a Greek grammarian, who probably lived about 147 A.D. His work consists of forty-one tales of mythical metamorphoses, and is chiefly valuable for the study of Greek mythology.

ANTONINUS, MARCUS AURELIUS. See AURELIUS MARCUS.

ANTONINUS, TITUS AURELIUS FULVUS BORONINUS ARRIUS, surnamed PIUS, was the son of Aurelius Fulvus, a Roman consul, whose family had originally belonged to Nemausus (Nîmes). He was born near Lanuvium, 86 A.D., and, having lost his father, was brought up under the care of Arrius Antoninus, his maternal grandfather, a man of integrity and culture, and on terms of friendship with the younger Pliny. Having filled with more than usual success the offices of quaestor and prætor, he obtained the consulship in 120 A.D.; was next chosen one of the four consuls of Italy; greatly increased his reputation by his conduct as proconsul of Asia; acquired much influence with the emperor Hadrian, by whom he was at length adopted as his son and successor in February 138 A.D.; and a few months afterwards, on Hadrian's death, was enthusiastically welcomed to the throne by the Roman people, who, for once, were not disappointed in their anticipation of a happy reign. For Antoninus came to his new office, with simple tastes, kindly disposition, extensive experience, a well-trained intelligence, and the sincerest desire for the welfare of his subjects. Instead of plundering the provinces to support his prodigality, he emptied his private treasury to assist the provinces. Instead of exaggerating into treason whatever was susceptible of unfavorable interpretation, he turned the very conspiracies that were formed against him into opportunities of signalling his clemency. Instead of stirring up the persecution of the Christians, and gloating over the sufferings of their martyrs, he extended to them the strong

hand of his protection through all the empire. Rather than give occasion to that oppression which he regarded as inseparable from an emperor's progress through his dominions, he was content to spend all the years of his reign in Rome, or its neighborhood. Under his patronage the science of jurisprudence was cultivated by men of high ability, and a number of enactments were passed in his name that are equally characteristic of his humanity and his justice. Antoninus died of fever on the 7th of March 161.

ANTONINUS, WALL OF, called GRAHAM'S DYKE by the natives of the district through which it passed, is the name given by historians to that series of defensive posts, connected by a rampart and a wall, which at one time extended across the island from the Frith of Clyde on the west to the Frith of Forth on the east. The former of these appellations it has received from the Roman emperor in whose reign it was erected; the origin of the latter is rather doubtful.

The nature and appearance of the wall when perfect have been described in very similar terms. "It consisted," says Stuart, "in the first place, of an immense fosse or ditch—averaging about 40 feet in width by some 20 in depth—which extended over hill and plain in one unbroken line from sea to sea. Behind this ditch on its southern side, and within a few feet of its edge, was raised a rampart of intermingled stone and earth, strengthened by sods of turf, which measured, it is supposed, about 20 feet in height, and 24 in thickness at the base. This rampart was surmounted by a parapet, behind which ran a level platform for the accommodation of its defenders. To the southward of the whole was situated the military way—a regular causeway road about 20 feet wide—which kept by the course of the wall at irregular distances, approaching in some places to within a few yards, and in others receding to a considerable extent."

Although in many parts of its course all traces of Antonine's wall have been obliterated, the line along which it stretched has been mapped out by Gordon and others with accuracy. Its entire length may be set down at about 36 English miles.

How many years Antonine's wall continued to be the boundary of the Roman territories in Britain it is impossible to say, but there is every reason for believing that it was so for only a brief period.

ANTONIO NICOLAO, a Spanish biographer, was born at Seville in 1617. After finishing his studies at Salamanca, he returned to Seville, and shut himself up in the royal monastery of Benedictines, where he devoted several years to writing his *Bibliotheca Hispanica*, a work in four vols. folio, two of which he published at Rome in 1672. The work consists of two parts; the one containing the Spanish writers who flourished before the end of the 15th century; the other—the part published by Antonio himself—treating of later writers. He was recalled to Madrid by Charles II., and died in 1684, leaving nothing but a magnificent library of over 30,000 volumes.

ANTONIUS MARCUS, the Roman orator, was born 143 B.C. After having filled the office of quaestor (113), he was appointed praetor in 104, and proprætor in the following year, the province of Cilicia being assigned to him. Here he was so successful in the war against the pirates, that a naval triumph was awarded him in 102. He was consul along with A. Postumius Albinus in 99, when he successfully opposed the agrarian law of the tribune Titius. He was censor 97, and held a command in the Marsic war in 90. Belonging as he did to the party of Sulla, he was put to death by order of Marius and Cinna when they obtained possession of Rome (87 B.C.).

ANTONIUS, MARCUS [MARK ANTONY], grandson of Antonius the orator, and son of Antonius Creticus, seems to have been born about 83 B.C. While still a child he lost his father, whose example, however, had he been spared, would have done little for the improvement of his character. Brought up under the disreputable Cornelius Lentulus Sura, whom his mother had married, Antony spent his youth in profligacy and extravagance. For a time he co-operated with the reprobate Clodius in his political plans, chiefly, it is supposed, through hostility to Cicero, who had caused Lentulus, his stepfather, to be put to death as one of the Catiline conspirators; but he soon withdrew from the connection, on account of disagreement which, appropriately enough, arose in regard to his relations to his associate's wife, Flavia. Not long after, in 58 B.C., he fled to Greece, to escape the importunity of his creditors; and at length, after a short time spent in attendance on the philosophers at Athens, found an occasion for displaying some of the better features of his character in the wars that were being carried on by Gabinus against Aristobulus in Palestine, and in support of Ptolemy Auletes in Egypt. A new chapter in his life was opened by the visit which he made to Julius Caesar in Gaul (54 B.C.). Welcomed by the victorious general as a valuable assistant in his ambitious designs, and raised by his influence to the office of quaestor, augur, and tribune of the plebs, he displayed admirable boldness and activity in the maintenance of his patron's cause, in opposition to the violence and intrigues of the oligarchical party. At length his antagonists prevailed, and expelled him from the curia; and the political contest became a civil war. The Rubicon was crossed; Caesar was victorious, and Antony shared in his triumph. Deputy-governor of Italy during Caesar's absence in Spain (49), second in command in the decisive battle of Pharsalia (48), and again deputy-governor of Italy while Caesar was in Africa (47), Antony was now inferior in power only to the dictator himself, and eagerly seized the opportunity of indulging in the most extravagant excesses of luxurious licentiousness—excesses which Cicero depicted in the *Philippics* with all the elaborate eloquence of political hatred. In 46 he seems to have taken offence at Caesar, because he insisted on payment for the property of Pompey which Antony professedly had purchased, but had merely appropriated. But the estrangement was not of long continuance; for we find Antony meeting the dictator at Narbo the following year, and rejecting the advances of Trebonius, who endeavored to discover if there was any hope of getting Antony to join in the conspiracy that was already on foot. In 44 he was consul along with Caesar, and seconded his ambition by the famous offer of the crown on the 15th of February, thus unconsciously preparing the way for the tragedy of the 15th of March. To the sincerity of his adherence to Caesar the conspirators themselves bore witness on that memorable day, by the care which they took to keep him engaged without while the daggers were doing their work within. This was the second great epoch in Antony's life. A brighter prospect than ever was then opened to his ambition. By his eloquence—a hereditary gift—he managed to stir up the minds of the populace against the assassins of Caesar, and drove them from the city. He made peace with the remaining representatives of the senatorial party, and almost seemed to have succeeded to the power and position of his unfortunate patron. But the youthful Octavius, whom Caesar had adopted as his son, arrived from Ilyria, and claimed the inheritance of his "father." Agreement was impossible, and war ensued. Octavius obtained the support of the senate and of Cicero; and the

veteran troops of the dictator flocked to his standard. Antony was denounced as a public enemy; and the city gave its loudest applause to the tirades of his most eloquent accuser. His cause gradually lost ground, and at last seemed to be totally ruined when his army was defeated in the siege of Mutina (43 B.C.) But escaping to Cisalpine Gaul, he formed a junction with Lepidus, and they marched towards Rome with 17 legions and 10,000 cavalry. The wily Octavius now betrayed his party, and entered into terms with Antony and Lepidus. Gaul was to be Antony's; Spain fell to the lot of Lepidus, and Africa, Sardinia, and Sicily were to belong to Octavius. A conjunct proscription followed, each of the partners in the villainous design bartering the life of his friends for the pleasure of destroying his foes. The detested author of the *Philippics* was given up to Antony's revenge; and, according to Appian, the number of the victims amounted to 300 senators and 2000 knights. In the following year Antony and Octavius proceeded against the conspirators Cassius and Brutus, who still maintained themselves at Macedonia; and, in the battles of Philippi, stamped out the last embers of republican Rome. While Octavius returned to Italy, Antony proceeded to Greece, and thence to Asia Minor, for the sake of recruiting his funds, completing the subjugation of the eastern provinces, and obtaining satisfaction about the conduct of the Egyptian queen during the recent contest. On his passage through Cilicia in 41 he was visited by Cleopatra, who came to answer the charges in person. She sailed up the Cydnus in a gorgeous bark, with a fantastic and brilliant equipage, and brought all her allurements to bear on the heart of the voluptuous Roman. Her success was complete; and he who was to have been her judge, was led captive to Alexandria as her slave. All was forgotten in the fascination and delight of the passing hour; and feasting and revelry found perpetual and ever-varying renewal. At length Antony was aroused by the Parthian invasion of Syria, and the report of an outbreak between Fulvia his wife and Lucias his brother on the one hand and Octavius on the other. On arriving in Italy he found that the war was over, and Octavius the victor; and the chief cause of disagreement being soon after removed by the death of Fulvia, a reconciliation was speedily effected between the triumvirs, and cemented by the marriage of Antony with Octavia, the sister of his colleague. A new division of the Roman world was agreed on at Brundisium, Lepidus receiving Africa, Octavius the west, and Antony the east. Returning to his province, Antony was for a time successful; his general, Ventidius, beating the Parthians, and Socius capturing Jerusalem and conquering Antigonus. But after another visit to Italy, during which the triumvirate was prolonged for five years, Antony sent away his wife, yielded himself completely to the evil influence of Cleopatra, indulged not only in licentiousness, but in tyranny, and allowed his affairs to be neglected or delayed. An expedition against the Parthians was a failure; but for this his success against Artavasdes, the Armenian king, in some measure compensated. Octavius at length determined to get rid of Antony, and had little need of invention to bring charges sufficient against him. About two years were spent in preparations and delays on both sides, and it was not till the year 31 that the fate of Antony was decided by the battle of Actium. Defeated and deserted, he once more sought refuge and repose in the society of Cleopatra, but was followed even there by his relentless rival. At first he made a gallant effort to defend himself, and partially succeeded. But convinced of the hopelessness of his position, and assured of the suicide of his mistress, he followed

the example which he was falsely informed she had given (30 B.C.)

ANTONOMASIA is, in rhetoric, the substitution of any epithet or phrase for a proper name; as "Pelides," or "the son of Peleus," for Achilles; "the Stagyrite" for Aristotle; "the author of *Paradise Lost*" for Milton; "the little corporal" for Napoleon the First. The opposite substitution of a proper name for some generic term is also sometimes called antonomasia; as, a "Cicero" for an orator. In both cases the figure is akin to metonymy.

ANTRIM, a maritime county in the north-east corner of Ireland, in the province of Ulster. It comprises without including the 50,803 acres under water, an area of 711,275 statute acres, of which 16,702 belong to the incorporated county of Carrickfergus. Pop.. 461,240.

In area Antrim is exceeded by eight other counties in Ireland, but in population by Cork and Dublin alone. A large portion of the surface, especially towards the east, consists of mountains and bogs; and it is computed that about 120,000 acres are irreclaimable. The mountains, occupying about one-third of the county, stretch from south to north, and terminate on the northern shore in abrupt and almost perpendicular declivities.

Lough Neagh, the largest lake in Europe, with the exception of Lake Ladoga, Lake Wener, and the Lake of Geneva, is principally in Antrim.

The climate is very temperate. The average annual rain-fall at Belfast is about 33 inches.

The soil varies greatly according to the district, being in some cases a rich loam, in others a chalky marl, and elsewhere a coating of peat. The chief feature in the tillage of a considerable portion of the county is the potato-fallow. The quantity of potato-land is commonly regulated by the quantity of manure that can be collected; and since the use of lime was introduced it has been greatly increased. After potatoes, wheat or oats are sown; if the latter, two or three crops are successively taken.

Antrim has long been distinguished for its linen manufacture, which is still the most important in the county. It was formerly carried on by hand-loom weavers, but the introduction of machinery has completely changed the character of the occupation. In 1841 there were about 240,000 spindles in operation, and now there are upwards of 580,000. There are also extensive paper-mills in the county, and various manufactures in connection with the trade of the district. The exports are linen, linen yarn, all kinds of grain, pork, bacon, hams, beef, butter, eggs, lard, potatoes, soap, and candles.

The communication by means of roads is good, and there are several important railway lines.

ANTRIM, a town of Ireland, in the county noticed above, half a mile from Lough Neagh, on the banks of the Six-mile Water, in a fertile and beautiful valley, 13 miles northwest of Belfast. Population, 1,831.

ANTWERP (Dutch, *Antwerpen*; French, *Anvers*; Spanish, *Amberes*; Old German, *Antorff*; from "aent werf," "on the wharf"), a province of Belgium, bounded by the Dutch province of North Brabant on the N., and by the Belgian provinces of Limbourg on the E., South Brabant on the S., and East Flanders on the W. The greater part of the province, which consists of an extensive plain of 1096 square miles, scarcely diversified by a single elevation, is sandy but fertile, producing grain, flax, hemp, fruit, and tobacco, as well as cattle, sheep, and horses; on the north and north-east, however, there are considerable tracts of morass and heath. The principal rivers, the Scheldt and its tributaries, the Rupel, the Nèthe, and the Dyle, are navigable to a large extent, while railways intersect the country in various directions, and there are also several canals

The chief towns are Antwerp, Mechlin (Malines) Turnhout, Lierre, and Boom. Population in 1901, 819,000.

ANTWERP, the capital of the province of the same name, is situated about 50 miles from the open sea, and 25 north of Brussels, in a level tract on the right bank of the Scheldt, which is there about 2200 feet broad, and has a depth at ebb-tide of from 30 to 40 feet, with a rise at spring-tides of 12 or 14. Antwerp seems to have been founded by people of Saxon race some time before the 8th century, when the Antwerpians or Ganerbian, as they began to be called, were converted to Christianity by St. Willebrod and some Irish monks. A certain Rohingus of that period styles himself prince of Antwerp; and mention is made of a market-toll in force in 726. In 837 the town fell into the hands of the Northmen, who kept possession of it for about sixty years. It was erected into a marquise of the Holy Roman empire by Henry II., in 1008, and, as such, was bestowed by Henry IV., in 1076, on Godfrey of Bouillon. About the beginning of the 12th century it had considerable commercial prosperity; and in the 13th, its municipal institutions took definite shape. It is worthy of notice that the law of 1290 contained provisions identical with those of the Habeas Corpus Act in England, maintaining the inviolability of the citizen's dwelling, and acknowledging the right of every man to be judged by his peers, and to have a voice in the imposition of taxes. As the result of such security and freedom, the commerce of the city rapidly increased. The English wools for the great manufactories at Louvain, Brussels, Tirlemont, Diest, and Leau, were imported through Antwerp; and the English merchants, who formed a "factory" there in 1296, received special protection by charters (1305, 1341, 1346, 1349) from the Dukes of Brabant, at that time in possession of the marquise. In 1338, while Edward III. of England was spending the winter in the city with his queen Philippa, she gave birth to Lionel, afterwards Duke of Clarence, and the event was celebrated by a magnificent tournament. To the king, then in great need of money, the merchants of Antwerp advanced 400,000 florins. The marquise passed successively into the hands of the counts of Flanders and the house of Burgundy, and returned to Brabant about 1406. In 1474 the town made over a large house in Billinck Street to the English, in 1550 an "English Bourse" was established, and in 1558 the beautiful Hop van Lyere — now a military hospital — was ceded for the accommodation of the merchants. Between 1488 and 1570 was the time of the greatest prosperity which Antwerp was destined to attain for several centuries. The discovery of America in 1492, and of the passage to India in 1497, produced a great change in all European navigation, and permanently altered the old courses of commerce. While, in consequence of this, the cities of the Hanseatic League had withered, and Venice, and Nuremberg, and Bruges were sinking into decay, Antwerp was growing daily more worthy of the name which she soon acquired, "the wealthy Antwerp." By contemporaneous writers, such as Guicciardini and Scribanus, the most glowing accounts have been left of her greatness. But from this height of prosperity the city was suddenly cast down by the wars of the 16th century. In 1576 it was taken by the Spaniards, and given up to a three days' pillage; it was besieged, though in vain, by the duke of Alençon in 1583; and, after a very obstinate defence, it fell before the assaults of the duke of Parma, whose triumphal entry took place on the 17th of August, 1585. Its glory departed; its commerce was ruined; its inhabitants were scattered. The Dutch, in their jealousy, endeavored to complete its ruin by building forts on the river to intercept the passage of ships; and finally, by the peace

of Westphalia, in 1648, the Scheldt was definitely closed. In 1794 the city fell into the hands of the French, who opened the river and made Antwerp the capital of the department of Deux Nèthes. Napoleon, who visited the place in 1803, attempted to make it a great military and commercial centre, and spent no less than \$10,000,000 in the construction of docks. It continued in French possession till 1814, when it was surrendered after the treaty of Paris by Carnot, who up to that time had defended it with great bravery against the allied army under Graham. From 1815 to 1830, Antwerp with the rest of Belgium united with Holland in forming the kingdom of the Netherlands. In 1830, during the Belgian revolution, the citadel was held by the old Dutch general Chassé, who resolutely refused to surrender. At length, however, in 1832 he was forced to capitulate to the French, under Marshal Gérard, and the city was handed over to the Belgians. All matters of dispute between Belgium and Holland being finally settled by the treaty of 1839, Antwerp has continued peacefully to advance in prosperity ever since.

Antwerp is the birth-place of a number of distinguished men in various departments, as the painters Vandyck (b. 1599), Teniers the elder (1582), Teniers the younger (1610), Jordaens (1594), Frans Floris (1520), Gonzales Cocques (1618); the philologist Gruter (1560), the geographer Ortelius (1527), the engraver Edelinck (1649), and, among more modern celebrities, Van Meteren the historian, Ogier the dramatist, and Henri Conscience the novelist. Rubens was born at Cologne, but his family belonged to Antwerp, and he was educated, resided, and died in the latter city.

According to the general census of 1846, Antwerp contained 88,487 inhabitants, of whom 85,961 were Roman Catholics, and 1312 Protestants. In 1851 the population was 95,501, and in 1901, 285,600, including the suburbs now situated within the fortifications. The majority of the inhabitants speak Dutch or Flemish, and the rest, for the most part, French or Walloon.

ANUBIS, an Egyptian deity, called in hieroglyphs *Anepu* or *Anup*, and in Coptic, *Anob* or *Anoub*. It appears from the hieroglyphic legends that he was the son of Osiris and Isis, not Nephthys, as stated by Plutarch. His name has no particular meaning in hieroglyphs, although it resembles the Coptic *anebe*, the appellation of a particular kind of dog. His worship was of the oldest period, and is found in tombs at Memphis, of the age of the 4th dynasty, at which period all dedications run in his name instead of that of Osiris, which did not appear till the 6th. At this time he is always styled resident in the sacred abode, and attached to the land of Ut, and lord of the Taser of Hades. At the earliest period he presided over the funeral rites and embalming of the dead, on account of having rendered these offices to his father Osiris. Besides his sepulchral character, Anubis was also called *Ap-heru*, "opener of the roads" or "paths," which were supposed to lead to heaven. He is represented with the head of a jackal, seldom with that of a man, and rarely with any head attire, although at the Roman period his head is surmounted by the pschent, or the crown of Upper and Lower Egypt. The jackal was his sacred living animal, and was embalmed after death, and this animal represented either the two hemispheres which environed the terrestrial globe, or the tropics. Figures of Anubis in porcelain are not uncommon in Egyptian collections, having been attached to the outer network of bugles which covered the mummies, but in other materials they are much rarer. The jackal, his animal and emblem, is, however, often placed on chests, or other sepulchral monuments. His worship commenced at the earliest

period of Egyptian history, and continued, in one form or another, till Egyptian paganism was superceded by Christianity. He was, in fact, one of the oldest, if not the oldest deity of the paganism of the world.

ANVIL, an iron block, with a smooth flat steel face, on which the malleable metals are hammered and shaped. The common blacksmith's anvil is built up of six pieces welded to a central core, viz., four corner pieces, a projecting end, with a square hole for the reception of a chisel with its edge uppermost, and a conical end for hammering curved pieces of metal. These six pieces are first roughly welded to the core, and the whole is then thoroughly hammered and suitably shaped. A thin facing of steel is next welded on and carefully tempered; the surface of this is then ground perfectly flat, and, if need be, polished.

ANWARI, one of the earlier Persian poets, was born in Khorassan, in the 12th century. He enjoyed the special favor of the Sultan Sandjar, whom he attended in all his warlike expeditions. He died about 1200.

ANWEILER, or ANNWEILER, a town of Bavaria, in the Rhine Palatinate, situated on the Queich, eight miles west of Landau, containing 2,734 inhabitants, who are chiefly employed in cloth weaving, brushmaking, tanning, and dyeing. Near it is the castle of Trifels, in which Richard Cœur de Lion was imprisoned in 1193.

ANXENOR, a Greek sculptor, a native of Naxos, who it is inferred lived about 500 B.C.

ANZIN, a town of France, in the department of Nord, situated on the Escaut (Scheldt), not far from Valenciennes, in the center of the most valuable coal-mining district in France, a large part of which takes its name from the town, and gives employment to about 6,000 persons. Anzin also possesses iron foundries, glassworks, breweries, and distilleries of considerable value. Population, 7,283.

AORTA, the great arterial trunk which, rising from the left ventricle of the heart, sends its branches ramifying through the whole body.

AOSTA, a town of the kingdom of Italy, the capital of a circle of the same name in the province of Turin, situated on the Dora Baltea, at the point where the roads over Great and Little St. Bernard meet, forty-nine miles north of Turin. The inhabitants, who number 7,669, carry on a considerable trade in wine, cheese, leather, and hemp.

APACHES, a tribe of Indians of the Athabascan family, and formerly very troublesome to the white settlers in Arizona, New Mexico, and Northern Texas. Their number is estimated at 10,000. See INDIANS.

APALACHICOLA, a town in Franklin county, Florida, situated at the mouth of the Apalachicola river, on the Gulf of Mexico, ninety miles southwest of Tallahassee, in the center of a rich cotton country. It is the location of a marine hospital, also contains a custom house, six churches, one weekly paper, a number of saw-mills, oyster and fruit canneries, foundries, and machine shops. Population, (1900), 3,077.

APAMEA, in Ancient Geography, the name of several Asiatic cities:—1. A large city of Syria, in the valley of the Orontes, so named by Seleucus Nicator, after Apama, his wife. 2. A large commercial city in Phrygia, which owed its existence to Antiochus Soter, and its name to his mother, Apama. It is identified with the modern *Denair*, where there are still a number of ancient ruins. 3. A city mentioned by Stephanus and Pliny as situated near the Tigris, the identification of which is still uncertain. 4. Now *Rum-Kala*, on the left of the Euphrates, opposite Zeugma. 5. The name given to Myrlea of Bithynia, by Prusias I., who rebuilt it. The ruins lie near Medania.

APANAGE, the provision in the form of lands or feudal superiorities made for younger sons by the kings of France. The custom of bestowing apanages was first established under the dynasty of the Capets; the rule at an earlier period being that the kingdom should be divided as equally as possible among all the members of the family on the death of the sovereign. In England the word is used popularly in a variety of cognate senses.

APATIN, a town of Hungary, situated on the left bank of the Danube, 125 miles south of Pesth. It has manufactures of woollen cloth and silk, dye-works, and a considerable trade in raw silk, hemp, madder, and wood. Population, 11,047.

APATITE (Gr., *apate*, "deception"), a mineral so named because it closely resembles various other minerals. It is composed principally of phosphate of lime, and is found in masses and crystals mostly in connection with tin. It is much used in the preparation of phosphate manures.

APATURIA, Greek festival held annually by all the Ionian towns except Ephesus and Colophon. But, unless at Athens, little is known of the manner in which it was conducted. There it fell in the month of *Pyanep-sion*, corresponding nearly to our November, and lasted three days, the occasion being one on which the various *phratræ*, or clans of Attica, met to arrange matters proper to each.

APE, a word of uncertain, and not improbably African origin, and by some supposed to have originated in an imitation of the animal's "chatter."

The zoological group denoted by the term "ape," when used in its widest sense, includes animals known by the familiar terms of "monkeys" and "baboons," as well as others bearing the less known names of "sapajous," "sakis," and "marmosets." In a more restricted sense the term "ape" is sometimes emphatically applied to those of the whole group which are most man-like in structure, namely, to the orang, the chimpanzee, the gorilla, and the gibbons.

Certain other animals, of very different structure, are generally associated in the same ordinal group with the apes. These other animals are the lemurs, or lemuroids; called also "half-apes," after their German designation of *Halbaffen*.

By Linneus these creatures, together with bats and man, were placed in his highest and first order, to which he gave the name "*Primates*," dividing its contents into the four genera, *Homo*, *Simia*, *Lemur*, and *Vespertilio*. The bats are now by universal consent removed from the order; and some eminent naturalists, notably Professor Alphonse Milne-Edwards, are disposed to remove from it the lemurs also; but in every case there can be no question but that the latter animals must at least rank as *sub-order*, for which the term "*Lemuroidea*" has been proposed.

The question whether man should or should not be placed in the same zoological order with the apes, must be decided according to the principles of classification adopted. If that classification be purely morphological, i.e., be determined by form and structure only, he cannot well be separated from them at least by any naturalist who would also include the lemurs in such order. The Linnean name "*Primates*" has been retained for the ape order, not only by naturalists who (like Professor Huxley) retain man within its limits, but also by others, who consider that he should be excluded from it. Cuvier, on the other hand, proposed for the original group of apes and lemurs only the term *Quadrumanes* (or four-handed), giving to that order, within which he placed man alone, the antithetical term *Bimanes*.

Priority of use determines our preference for the Linnean name "*Primates*," but this preference is rein-

forced by considerations derived from anatomy and physiology.

The whole of the apes, as indeed the whole of the half-apes also, differ from man in having the great toe, or (as it is called in anatomy) the *hallux*, so constructed as to be able to oppose the other toes (much as our thumb can oppose the fingers), instead of being parallel with the other toes, and exclusively adapted for supporting the body on the ground. The prehensile character of the *hallux* is fully maintained even in those forms which, like the baboons, are terrestrial rather than arboreal in their habits, and are quite quadrupedal in their mode of progression. It was this circumstance that led Cuvier to bestow the name *Quadrumanes* upon the apes and lemurs. Now, if we accept, with Professor Owen, as the definition of the word "foot," "*an extremity in which the hallux forms the fulcrum in standing or walking*," then man alone has a pair of feet. But, anatomically, the foot of apes (as well as that of half-apes) agrees far more with the foot of man than with his hand, and similarly the ape's hand resembles man's hand and differs from his foot. Even estimated physiologically, or according to use and employment, the hand throughout the whole order remains the *special* prehensile organ; while the predominant function of the foot, however prehensile it be, is constantly locomotive. Therefore the term *Quadrumana* is apt to be misleading, since, anatomically as well as physiologically, both apes and men have two hands and a pair of feet.

Apart then from man, the apes constitute the first sub-order of that which is the most man-like order of the class *Mammalia* (beasts), and which bears the name "*Primates*."

Such being the position of apes as a whole, they are zoologically divisible into a number of more and more subordinate groups, termed respectively *families*, *sub-families*, and *genera*.

The great group of apes is divisible into two great families, which are sharply distinguished by geographical distribution as well as by structural differences. The first of these families, *SIMIADÆ*, is strictly confined to the warmer latitudes of the Old World. The second family, *CEBIDÆ*, is as strictly confined to those of the New World.

Of the three sub-families into which the *Simiadae* are divided, the first, *SIMIINÆ*, contains only the orang, the chimpanzee, the gorilla, and the gibbons. These are the creatures which, anatomically, are the most like man of all the apes, on which account they are often called the "anthropoid" apes. They are also termed, on account of the relative breadth of their breast-bone or sternum, the "latisternal" or "broad breast-boned" apes.

The orang (*S. satyrus*) constitutes the genus *Simia*, which gives its name to the whole family (*Simiadae*), as well as to the sub-family (*Simiinae*) to which it belongs. Of this genus there is but one certain species, which is, however, subject to considerable variation. The orang is exclusively confined to the islands of Borneo and Sumatra, where it frequents the swampy forests near the coast. It attains a height of about 4 feet 4 inches; but its bulk is considerable, its legs, however, being exceedingly short. Its arms, on the contrary, are exceedingly long, reaching down to the ankle when the animal is placed in an erect posture. In harmony with this structure the animal rarely assumes, naturally, a truly erect posture, but walks resting on the knuckles of its hands and the outer sides of its feet, the soles of the latter being turned mainly inwards. The animal is covered with long, reddish-brown hair, and there are no naked spaces on the hinder part of the trunk. There is no vestige of a tail. The hands are very long; but the

thumb is short, not reaching to the end of the metacarpal bone of the adjacent (*index*) digit. The feet have exceedingly long toes, except the great toe, which only reaches to the middle of the proximal phalanx of the index digit of the foot. The brain of the orang has the cerebrum greatly convoluted, and is altogether more like the brain of man than is that of any other ape.

The chimpanzee and gorilla together form the genus *Troglodytes*. Both of these species agree with the orang in being destitute of any rudiment of a tail, in having no cheek pouches, and no naked spaces at the hinder part of the trunk, as also in possessing tusk-like canines, and in the habit of resting on the knuckles of the hand in walking on the ground and of mainly dwelling in trees. The chimpanzee (*T. niger*) is found in Western Africa, from the Gambia to the Benguela, and extending inland to 28° E. long. It is the most man-like of the latisternal apes in the proportion of its arms, as these only reach a little below the knees when the body is placed upright. It is of moderate stature, never appearing to exceed 5 feet in height. In disposition it is lively and intelligent, and its playfulness in captivity contrasts greatly with the lethargy of the orang.

The gorilla (*T. gorilla*) is also West African, but has a less extended range than the chimpanzee, namely, between the Cameroon and Congo rivers only. It is the largest ape known, attaining a bulk of body considerably exceeding that of a man, though, on account of the shortness of its legs, it never seems to exceed the height of 5 feet 6 inches. It was first made known to moderns by Dr. Thomas Savage, but it appears to have been seen by Hanno of Carthage, in his voyage south of the pillars of Hercules. The gorilla has not such dark hair as has the chimpanzee, being blackish-dun in color, and becoming grey when old. Its skin, however, is black. Its arms are longer than those of its congener, reaching half-way down the shin. The forehead is not rounded, the supra-orbital crest being more prominent than even in the chimpanzee: the ears too are smaller relatively. The larynx is provided with enormous air-sacs, communicating with the verticles and meeting the trachea, and extending to the axilla with age. There is no os intermedium in the carpus, and there are thirteen pairs of ribs.

The gibbons, or long-armed apes, form the genus *Hylobates*, confined in the present day to the south-eastern continent of Asia and the Indian Archipelago. There are several species, but individual variation and sexual difference in color are so great that their limits are not yet well defined. One well-marked species, the largest of the genus, is the siamang (*H. syndactylus*) of Sumatra, which is remarkable as being the ape with the best developed chin and widest breast-bone. In captivity their manners are gentle, although their activity is surprising; especially remarkable are the enormous distances they can swing themselves by their long arms. In spite of this length of arm, which seems to render their bodily proportions so unlike those of man, the length of leg, when compared with the length of the trunk of the body, is more human than in either of the two preceding genera. Another point in which they approach nearest to man, is the quality of voice which at least some of the species (e.g. *H. hoolock*) possess.

On leaving the gibbons, which close the series of Anthropoid apes, we come at once upon animals of very different aspect, and from creatures devoid of any vestige of a tail, we pass at once to monkeys, which have that organ at its maximum of development. These are the two genera *Semnopithecus* and *Colobus*, which so closely resemble each other as to be hardly separable, but for their different geographical distributions. Together they form the sub-family *Semnopithecina*, and

agree in having, as well as the long tail, arms shorter than the legs, and a slender body.

One species, *S. entellus* (the hounaman), is an object of religious veneration to the Hindoos. Another very remarkable kind is found in Borneo. It is *S. nasalis* (the kahau, or proboscis monkey), and, as its name implies, it has an exceedingly long nose. In the young state, the nose is much smaller relatively, and is bent upwards.

We now come to the concluding genera of the apes of the Old World, together forming the third sub-family *Cynopithecinae*. This is a very natural group, but one exceedingly difficult to subdivide in a satisfactory manner, because the different characters gradually alter as we pass from round-headed, long-tailed, and comparatively slender monkeys to dog-faced, short-tailed, and massive baboons. All the *Cynopithecinae* agree in having pretty well-developed thumbs and a single stomach, as also in having the sides of the face distensible, serving as pockets wherein food may be temporarily stored, and technically called "cheek pouches." The hair is often annulated.

The first genus, *Cercopithecus*, includes those species of the sub-family, which by their length of tail and comparative slenderness, most nearly approach the members of the preceding sub-family. Many of the species (e.g. the Diana and white-nosed monkeys) are very attractive animals.

The next genus, *Macacus*, is Asiatic, with the exception of the Barbary ape, or magot (*M. inuus*), which is found in Northern Africa and on the Rock of Gibraltar. Already, in some of the *Cercopithecii*, notably in the mangabeys, the muzzle has acquired a greater prolongation. This becomes still more marked in the *Macaci*. It is this greater production of muzzle, the greater size in the ischiatic callosities, the frequent shortness of the tail, and the different geographical distribution, which can alone be given as differentiating these animals from the *Cercopithecii*. In some kinds the tail is long. Occasionally (as in the wonderoo, *M. silenus*) it is tufted at the end and short. Sometimes, as in *M. nemestrinus*, it is very short, and occasionally, as in *M. inuus*, it is absent. On account of this absence of tail this species has sometimes been made the type of a distinct genus, *Inuus*.

The *Macaci* present us with the most northern forms of apes, namely, that of Gibraltar, and *M. speciosus* of Japan.

The remaining apes of the Old World are the baboons, which are entirely confined to Africa, and to that part of Asia which is zoologically African, namely, Arabia. These animals, which constitute the genus *Cynocephalus*, have the characters of the *Macaci* still further developed in having still larger callosities, and a muzzle so extremely produced as to give the head the appearance of that of a dog, whence their generic name. The general form has also here become very massive, and the limbs being sub-equal in length, the appearance, like the locomotion, is quadrupedal. But the baboons have not only the muzzle so greatly produced, they have also the nostrils terminal in position like those of a hound and unlike what we have yet met with.

The baboons are the least arboreal and the least frugivorous of the Old World apes, some species, e.g., the chacma of Southern Africa (*C. porcarius*), living habitually amidst rocks, and feeding on eggs, large insects, and scorpions, as well as on vegetable food.

The *Cebidæ* are more thoroughly arboreal in their habits than are the *Simiade*. Ranging over tropical America, they have their headquarters in the forests of Brazil, a region where most animal forms put on a more

decidedly aboreal character. Accordingly, it is amongst the *Cebidæ* that we meet with, for the first time, a special arboreal organ—namely a prehensile tail. Such a tail has its free end curled, and capable of grasping with greater or less tenacity the objects about which it coils.

None of the *Cebidæ* attain the bulk of the larger baboons, nor have any such prominent muzzles as have the latter.

The *Cebidæ* are subdivisible into five sub-families:—1. *Cebinae*; 2. *Mycetinae*; 3. *Pitheciinae*; 4. *Nyctipithecinae*; and 5. *Hapalinae*.

The first sub-family consists of the four genera, *Ateles*, *Eriodes*, *Lagothrix*, and *Cebus*.

The genus *Ateles* is composed of the spider monkeys, which, as their name implies, have long and slender limbs. They have also a very long tail, which is in the highest degree prehensile, being naked beneath towards the tip, for more secure prehension. So powerful is the grasp of this organ that the whole body can be sustained by it alone. It even serves as a fifth hand, as detached objects, otherwise out of reach, can be grasped by it, and brought towards the hand or mouth.

The spider monkeys are very gentle in disposition, and, by this and by their long limbs and special fitness for tree-life, seem to represent in an analogous manner in the New World the gibbons of the Old.

Three species of ape having much general resemblance to spider monkeys have been erected into the genus *Eriodes*, (*E. arachnoides*, *hemidactylus*, and *hypoxanthus*). These animals, which are from South-Eastern Brazil, have the fur woolly, the thumb more or less rudimentary, the nails very laterally compressed, and the nostrils more approximated than in the other *Cebidæ*.

The woolly monkeys, *Lagothrix*, differ from the two preceding genera in having the thumbs well developed. Their nails are compressed laterally, as in *Eriodes*, but their nostrils are not approximated. As their name implies, their fur is woolly. Like *Eriodes* and *Ateles*, they have the tail strongly prehensile, and naked beneath towards the tip.

The genus *Cebus*, the typical genus of American apes, is composed of the sapajous, so commonly seen in captivity, and so much used for the exhibition of tricks of various kinds. Smaller in size, they are more robust in form than are the spider monkeys. They have well-developed thumbs, and their tail is curled at the end, but, not being naked beneath, is less strongly prehensile than in the three preceding genera. The sapajous have a pleasing voice, a flute-like whistling tone.

The next sub-family of American apes is very distinct, consisting, as it does, of a single genus, *Mycetes*, composed of the howling monkeys. These creatures are the most bulky of the American apes, and are those the muzzles of which are the most projecting. The howlers have long, very prehensile tails, naked beneath towards the tips. Their thumbs are well developed. Some of the species show much brilliance of color, with bright red or golden hair on the flanks. There is, however, so much individual variation, or so many local varieties, that the species are as yet very little determined. The sexual difference in color is great in one species—the male being deep black, and the female pale straw color.

The third sub-family of American apes is composed of very peculiar forms, termed Sakis, which are subdivided into two genera, *Pithecia* and *Brachyurus*, according as the tail is long or short. They are together distinguished from all the *Cebidæ* yet noticed, by not having the tail prehensile, even when long; also by having the lower incisor teeth inclined forwards, instead of standing up vertically.

The *Brachyuri* are the only American apes with short

tails, and they are the least arboreal, frequenting bushes rather than trees. They are very timid creatures, and gentle, and rather slow in their movements.

The beautiful little squirrel monkey, or Saimiri, and three allied species (*Ch. ustus entomophagus*, and *Erstedii*), form the genus *Chrysotrrix*. They are distinguished from all other apes by the great backward prolongation of the bony cranium, the orbits of which, though smaller than those of *Nyctipithecus*, are, nevertheless, separated, but by an imperfect bony septum.

A few other kinds of American apes, together forming the genus *Callithrix*, somewhat resemble the night apes, but the eyes are much smaller, and the nostrils wider apart. They differ from *Chrysotrrix* in having small canine teeth, and the tail furnished with long hairs. The species of this genus are—*Moloch*, *Personatus*, *Amictus*, *Gigo*, *Melanochir*, *Discolor*, *Donacophilus*, *Ornatus*, and *Castaneiventris*.

There remains now to notice but one more group of apes, those which have been classed as the last subfamily—the *Hapalinae*, marmosets, or outitis. In several, and especially the more commonly seen species, a tuft of long hairs projects outwards and backwards on each side of the head. These animals are very small, the largest being about the size of squirrels. They are, like squirrels, active in their motions, and arboreal in their habits, living in small troops, and eating insects as well as fruit. They are very difficult to keep in captivity in northern climates; but, nevertheless, they have occasionally bred in captivity, bringing forth as many as three at a birth, while all the other apes habitually bring forth but one.

THE EXTERNAL FORM AND CLOTHING.

The difference in bulk between the different members of the group (e.g. *Troglodytes* and *Hapale*) is extreme, being greater than that between a man and a common squirrel.

The proportions of the body as regards the relative lengths of the two pairs of limbs one with the other, and both with that of the trunk, vary considerably. The length of the tail presents some noteworthy points. At its first appearance it is found at once at its greatest absolute length, and also greatly developed relatively, being about twice the length of the trunk. Its greatest relative length is, however, attained in *Ateles*, where it reaches three times the length of the trunk. The form of the head presents great differences—it may be rounded, produced vertically, drawn out posteriorly to an extreme degree, or anteriorly. A production of the muzzle, necessitated by the presence of large teeth, exists already in *Troglodytes*; but in the baboons, not only is this prolongation carried much further, but the terminal position of the nostrils gives an emphatically dog-like aspect to the face.

The eyes may be small compared with the size of the head, as in the baboons; they may, on the contrary, attain a relatively enormous size. They are always forwardly directed, and never much more separated one from another than in man. They may, however, be much more closely approximated.

The external ears are always well developed, and have very generally their postero-superior angle pointed. They may be large and small in the same genus, as in *Troglodytes*. Only in the gorilla do we find present, even in a rudimentary condition, that soft depending portion of the human ear which is termed the "lobule."

The nose has scarcely ever more than a very slight prominence, and yet an enormous development is to be met with in *Semnopithecus nasalis*; while in *S. roxelanae* we find a sharply prominent, though smaller and extremely upturned nose.

The lips are generally thin, but may be very extensive, as in *Simia*.

The hands are generally provided with thumbs, though these organs (as in *Colobus* and *Ateles*) may be represented only by small nailless tubercles.

The *hallux* (great toe) is never rudimentary like the pollex. It is never, as it often is in man, the longest digit of the foot, but is constantly the shortest one. As compared with the entire length of the foot, it is most human in the chimpanzee and some gibbons.

All the apes, without exception, differ from man in having the body almost entirely clothed with copious hair, and especially in never having the back naked.

Great brilliance of color is sometimes found in the naked parts of the body, particularly in the *Simiadae*, and especially in the region of the face.

The skeleton of apes generally, if we except the tail, consists of but few more bones than that of man. The proportions of its parts, except as regards the relative length of the limb bones, are also much as in man; nor are their shapes, except those of the jaws and haunch bones, greatly different. The same general resemblance may be predicated of their minute structure, though the osseous tissue is generally rather dense, and the medullary cavity in the long bones is small.

THE MUSCLES.

The muscles are very similar in number, distribution, and form to those of man, except that in the long-tailed forms.

The absolute size of the brain never in any ape approaches that of man. Thus the cranial capacity is never less than 55 cubic inches in any normal human subject, while in the orang and chimpanzee it is but 26 and 27½ cubic inches respectively.

The teeth of apes consist, as in man, of incisors, canines, premolars, and molars; but the series of teeth nowhere forms so perfect an arch as in man, the opposite series of grinding teeth tending to become more parallel. No ape has the teeth placed in one uninterrupted series in each jaw, as is the case in the human species, but there is always a small interval between each upper canine and the adjacent incisor, and between each lower canine and the adjacent premolar. This condition is due to the excessive size of the canines, the interspaces giving passage to the apices of these teeth.

The alimentary, circulating and excretory organs of apes closely resemble those of man. The mouth is always guarded by *lips*, which, though generally thin, are often very mobile and extensible.

The *tongue* is much longer, relatively, in most apes than in man; but it may closely resemble his, as does that of the orang.

The *stomach* is simple in all the apes except the *Semnopithecinae*. It is especially human in shape in *Hylobates*, except that the pylorus is somewhat more elongated and distinct.

The *liver* may be very like man's, especially in *Hylobates*, the orang, and the chimpanzee; but in the gorilla, both the right and left lobes are cleft by a fissure almost as much as in *Cynocephalus*.

The *larynx* is in many apes furnished with sac-like appendages. These are different in different species as regards number, size and situation.

The *lungs* have generally the form of those of man; but the right lung may have four lobes.

The great *arterial trunks* in *Simia* and *Troglodytes* are arranged as in man. In *Hylobates* and the lower apes, however, the left carotid may take its origin from the innominate artery.

THE GENERATIVE ORGANS.

The generative organs, are, in common with the other parts of the body, formed on the same model as in the human species.

Gestation in the lower *Simiadae* lasts about seven months, but in the *Hapalinae* only three months.

Menstruation occurs periodically, but the excretion is less sanguineous than in the human species.

Lactation lasts, in the better known forms, for an average of six months, and the young are carried at the breast in a very human attitude.

There appears as yet to be no evidence of the existence of apes earlier than during the Miocene period. This absence of evidence must by no means be taken as a conclusive proof of their non-existence, since, as Dr. Falconer has pointed out, we ought not to expect to find ape fossils often. We ought not to expect this, because the agility and arboreal life of these animals enable them to escape local inundations, and other causes of destruction and speedy burial, to which more sluggish and terrestrial animals are exposed. When they fall dead they are almost immediately devoured by carnivorous animals and feeders on carrion, and it is owing to this that their remains are so rarely found in India, on which account the Hindoos believe that they bury their dead.

GEOGRAPHICAL DISTRIBUTION.

The apes are, as far as is yet certainly known, at present almost confined to tropical latitudes. Their most northern limits in the Old World are Gibraltar. In the New World the highest northern latitude certainly known to be attained is 18° or 19° in Southern Mexico, but they possibly reach even latitude 23° . Father David, however, sees no reason (considering the severity of the climate of Moupin) why apes should not also be found in the mountains of Northern China, and the natives have repeatedly assured him they are to be found there. Southward, apes are found to near the Cape of Good Hope, and the island of Timor (*Macacus cynomolgus*), in the Indian Archipelago, in the Old World, and to about 30° in Brazil and Paraguay, in the New World. As to vertical extent, a *Semnopithecus* has been seen near Simlah, at a height of 11,000 feet; Dr. Hooker saw monkeys in the Himalaya at an elevation above 8,000 feet; and *Semnopithecus roxellanae* and *Macacus thibetanus* were found by Father David inhabiting the Snow Mountains of Moupin, in Thibet, at an elevation of about 3,000 metres, where frost and snow last several months.

Some of the localities richest in monkeys are islands, such as Ceylon, Borneo, Sumatra, and Java; and apes are also found in Trinidad, and the island of Fernando Po. There are, however, certain islands which seem eminently well suited to support an ape population, where apes, nevertheless, are conspicuous by their absence. Such are the West Indian Islands, Madagascar, and New Guinea; moreover, no ape inhabits tropical Australia. These facts become the more remarkable, if, as Father David suspects, apes exist in Northern China to-day. Evidently it is not climate which prevents their existing in Central Europe now. The continents of Africa, south of the Sahara; of Asia, south of the Himalaya; and of America, from Panama to the southern part of Brazil, are, with the islands before mentioned, the special ape regions of the existing fauna.

There is a remarkable difference between the ape population of the New and the Old World, the latter being inhabited exclusively by *Simiadae*, the former as exclusively by the *Cebidae*. Europe has but a single ape species; and Asia, north of Himalaya, has but the few

found in Thibet, China, and Japan. Africa, north of the Sahara, is zoologically a part of Europe, and there also *Macacus inuus* is found, which is the only African species of the genus.

One form of *Macacus*, and a very peculiar one (*M. niger*), is found in the islands Batchian and Celebes; and it is a noteworthy fact that this, the most baboon-like of all the *Macaci*, should only exist in a region so extremely remote from Africa. The genus *Macacus* is the most widely spread of any existing genus—namely, from Gibraltar, North Africa, Thibet, and Japan (perhaps even from Northern China), down to the island of Timor, and from the north-west of Africa in the west, to Batchian, Japan, and the Philippine Islands in the east. In ancient times this genus seems to have extended to France, and even to Essex. It is interesting to note that, in the Miocene period, the geographical range of the apes of India was much greater. Gibbon-like monkeys existed in the south of France, while forms intermediate between *Semnopithecus* and *Macacus* abounded in Greece.

In America, north of Panama, the genera as yet known to be represented are *Chrysothrix*, *Nyctipithecus*, *Cebus*, *Ateles*, *Mycetes*, and *Hapale*, in Veragua; *Nyctipithecus*, *Cebus*, *Ateles*, and *Mycetes*, in Costa Rica and Nicaragua; *Ateles* and *Mycetes*, in Guatemala; and *Ateles*, in Southern Mexico. Brazil is, of course, the headquarters of the American apes; but different portions of that vast region have a somewhat different ape fauna. Thus the genus *Eroides* appears in South-Eastern Brazil to represent the species of *Ateles* inhabiting the more northern and western parts of the empire. Southwards, the genera *Cebus*, *Mycetes*, *Chrysothrix*, and *Callithrix* extend furthest; but they do not probably all extend to the furthest limit yet known, namely, 30° S. The species found farthest south are *Mycetes caraya*, *Cebus fatuellus*, and *Callithrix personatus*.

By universal consent apes are placed in the highest rank of all brutes, and, excepting man, are generally taken to be the most perfect animals of the mammalian class. It may be questioned, however, whether, if the animal man had never existed, this place would be assigned them by any observing intelligence. The half-apes, or lemurs, commonly placed in the same order with them, are certainly inferior mammals; and it might be contended that the perfection of the mammalian type is rather to be found in the *Felidae* (or cat family), by reasoning analogous to that by which it might also be contended that birds (with their different limbs, perfect circulating and respiratory systems, acute sense organs, complex instincts, and teachableness) are really the highest of all vertebrate animals, and represent the vertebrate type of structure carried to the highest degree of perfection yet attained.

The question as to which animals are most nearly allied to apes is one by no means easy to answer. Leaving man aside (whose close anatomical resemblance to apes is so obvious), it is at present extremely difficult to say what are the apes' true zoological affinities. It is to be hoped that future palæontological researches may afford us materials for tracing these out; but at present a chasm separates the apes from every other group of animals.

But if the apes cannot be considered to show evidence of genetic affinity with any other mammalian order, do they constitute so homogeneous a group as to suggest the former existence of one ancient root-form common to them all? To this question it may be answered that the differences between the *Simiadae* and *Cebidae* are such as to render it doubtful whether they may not have had respectively quite different origins, and whether their resemblances may not have been superinduced by similarity of needs and conditions.

APELDOORN, a flourishing town in the Netherlands, in the province of Guelderland, 17 miles N. of Arnheim, with large paper mills and a population, in 1901, of 26,738. A short distance off is the Castle of Loo, the favorite residence of King William I.

APELLAS, a Greek sculptor, mentioned by Pausanias as the author of a group at Olympia, representing a quadriga, with the statues of a charioteer and of Cynisca, the sister of Archelaus. A bronze sculptor of the same name, and probably the same person, occurs in Pliny.

APELLES, the most celebrated of ancient Greek painters. The date assigned to him by Pliny is 332 B.C., and with this agrees the fact of his having been the court painter of Alexander the Great, who it was said would allow no one else to paint his portrait, though, in point of fact, portraits of him by other artists are known. Apelles had worked before then for Philip, the father of Alexander, and with a career of nearly half a century, was at work after in the time of the first successors to Alexander's empire. He was born at Colophon, where it appears his father Pytheas, also a painter, resided. His first instructor was a certain Ephorus, of Ephesus, which was then the centre of the Asia Minor school of painting; the rival school being that of Sicyon in Greece proper, whither Apelles next proceeded, apparently to undergo the stricter discipline in drawing for which that school was renowned, and perhaps also, as is said (Plutarch, *Arat.*, 13), to win a share of the good fortune and fame of its leaders. He was here in the neighborhood of Corinth, and it was probably then that he was taken by the beauty of the young Lais, on seeing her drawing water at the fountain of Peirene. Another incident, that of his having seen the notorious Phryne bathing at Eleusis, and from this conceived the design of his picture of Aphrodite Anadyomene, would also fall about this time, for the two reasons that Phryne's celebrity occurred in the period before Alexander, and that Apelles is not known to have made a second stay in that district of Greece. From Sicyon he went to the Macedonian court, and was there employed until Alexander departed on his expedition into Asia, on which the painter accompanied him as far as Ephesus, where he settled. Of the intimacy between him and his royal patron there are a number of stories, which, however, from the variety in the telling, may be without foundation in fact. According to Pliny, Alexander having betrayed ignorance by some remark about painting, was told by Apelles to be silent, lest the boys who were rubbing down colors in the studio might laugh at him. Still, so far as the painter's readiness of rebuke is concerned, these stories are confirmed by other incidents, as when he told an artist, who boasted of his speed in work, that the wonder was why he could not produce more of such stuff in the same time; or, when having once accepted correction from a shoemaker about a wrongly painted boot in one of his pictures, he declined further criticism from him, with the observation which has since become a proverb, *Ne supra crepidam sutor judicaret* (Pliny, xxxv. 84).

APENNINES, an extensive range of mountains traversing the entire extent of the Italian peninsula, and forming, as it were, the backbone of that country. The name Apennines is probably of Celtic origin, and derived from *pen*, properly signifying a head, or mountain height. The Apennines may be considered as a southern branch of the great Alpine system of Europe. Both the mountain systems have a general resemblance as regards the age and lithological character of the rocks and strata which compose them. Geographers have differed as to the point where the Apennines are to be

distinguished from the Alps. Some have placed it at the pass of Bocchetta; others at the Col di Tenda; and others at the low pass which runs from Savona to Cairo. Strabo, who gives a very accurate account of the general features and direction of this chain, considers it as beginning in the vicinity of Genoa. From Col di Tenda the Apennines run in a semicircle round the Gulf of Genoa, in a general direction from west to east; they afterwards turn to the south, and traverse the whole of the Italian peninsula to the Strait of Messina. The entire length of the chain is about 600 miles measured in a direct line, and about 800 miles if measured along the windings.

The *Northern Apennines* include what are usually designated the Ligurian and Tuscan Apennines. The Ligurian Apennines extend from the Maritime Alps past Monte Gisa to the borders of Tuscany.

The *Central or Roman Apennines* comprehend that part of the chain between Monte Cornaro, in which the Tiber rises, and Monte Velino, north of Lake Fucino. Its general direction is from N.N.W. to S.S.E. or nearly parallel to the Tiber. The descent towards the Adriatic is continuous and direct, towards the Mediterranean it forms two distinct inclined planes.

The *Southern Apennines* include the remaining portion of this chain. From Monte Velino they proceed in a south-easterly direction to the valley of the Ofanto, which cuts through the range. South of that limit, one short branch extends eastward towards Altamura, another runs westward to the neighborhood of Salerno, while the main chain is prolonged nearly due south to the heights of Aspromonte overlooking the Strait of Messina. As a general rule, the same formations occur in the Apennines as in the Alps, and the system usually consists of a central ridge having secondary and lower ridges running parallel with the main range, the intervening country being formed of but slightly disturbed newer Tertiary deposits. Thus, in that portion of the Apennines which borders on and extends into Tuscany and Bologna, the system consists of two parts. The one which is most distant from the Mediterranean forms the Apennines proper; here the Eocene beds prevail, and are covered, especially on the north flank, by Miocene and Pliocene beds; the axes of elevation are numerous and parallel to each other, following strikes which run from W.N.W. to E.S.E., and from N.W. to S.E. The other part is nearer the Mediterranean, and is remarkable for its richness in metalliferous ores. The district of Carrara abounds in marbles belonging to the Liassic and Oolitic periods.

APERIENTS are substances, either foods or medicines, employed to bring about intestinal evacuations. Brown bread, figs, prunes, oatmeal, and berries fall within the first class, and by their judicious use the need of drugs can often be avoided. Aperient drugs may be divided into laxatives, of which manna, magnesia, olive oil, sulphur, and castor oil in small doses are the best-known, and into the two classes of purgatives—cathartic and drastic. Of cathartics the chief are aloes, rhubarb, senna, and castor oil in large doses; of drastics colocynth, croton oil, jalap, and podophyllin. There are a number of saline aperients, such as the sulphates of potassium, sodium, and magnesium, the tartrates of potassium and sodium, citrate of magnesium, etc.

APENRADE, a town of Prussia, in Schleswig, beautifully situated on the Apenrade fiord, thirty-eight miles north of Schleswig. Population, 6,068.

APHASIA, a term applied to indicate a condition in which the function of expressing ideas by articulate sound is arrested, perverted, or destroyed, in consequence of lesion of the brain. Loss or perversion of the power of expressing ideas by written signs is often asso-

ciated with this condition. The term Aphasia is generally held to comprise two great varieties: (1), Amnesic Aphasia, in which the memory of words is lost or perverted; and (2), Ataxic Aphasia in which the function of articulation is lost or perverted. Although this broad distinction is very properly made, it very rarely happens that a case occurs in which the two conditions are not to a greater or less extent coexistent.

Amnesic aphasia is symptomatised very variously. The earliest, and most common indication consists in the loss of the memory of substantives and names, other parts of speech being properly applied; in such cases a periphrasis is employed to express the term. The memory of a language with which the patient had been thoroughly conversant may become lost. Terms are persistently misapplied; for instance, in recorded cases "pamphlet" has been used for "camphor," "hoghead" for "sugar," "horse" for "man," &c., &c. This symptom has been named *Heterophasia*. In *ataxic* aphasia—the function of articulation is completely or partially lost, the patient being only able to indicate by signs that he is conscious of the idea conveyable by the term; thus an ataxic aphasic, who had been an engine-driver, when asked what had been his trade, could only express himself by imitating the sound made by an engine when starting, "Hish, hish, hish."

Aphasia, whether amnesic or ataxic, may, but seldom does exist dissociated from absolute insanity.

Great interest has centred around the question of the pathology of aphasia, as many observations have been adduced which appear to connect with this condition lesion of a specific portion of the brain, and from this it has been sought to deduce the absolute localisation of the function of speech in the hemispherical ganglia.

APHORISM is a terse and definite statement of a principle or important doctrine in science or philosophy. The word has been used as the title of some well-known works—as the *Aphorisms of Hippocrates*, the *Aphorisms of the School of Salerno*, and the *Aphorisms of Boerhaave*, which represent respectively the medical doctrines of the 5th century B.C., and the 12th and 17th centuries of the Christian era. One of the best specimens of a philosophical treatise wholly written in aphorisms is the *Novum Organum* of Lord Bacon.

APHRODITE [VENUS]. From the accepted meaning of the name Aphrodite, "born in the foam of the sea," together with Hesiod's account of her appearing first in the waters round Cythera, and finally landing on Cyprus; and from the further explanation of her principal title *Urania*, to the effect that she derived her being from the maimed Uranos, this goddess might appear to have been of pure Greek origin, as indeed would also be gathered from the fact of Homer placing her among the Olympians, and calling her a daughter of Zeus and Dione. But her connection with Cyprus, which even Homer admits, calling her *Kypris*, and in the *Odyssey*, speaking of her visit to Cyprus, where were a temple and an altar for her, has provoked an inquiry as to how far her worship may have been based on that of Astarte, the patron goddess of the Phœnician settlers in that island, the more so since the worship of Aphrodite *Urania* flourished mainly in the track of the Phœnician factories in the islands and in Greece proper. The obvious facts are—first, that Aphrodite was not associated with any of the legendary families of the mainland of Greece, her mortal favorites—Adonis, Pygmalion, Anchises, Æneas, Paris—being all non-Hellenic, and more or less Asiatic in origin; secondly, that her worship in Cyprus, as Herodotus was told (i. 105), had been transplanted from Acadon, where was the oldest temple of a goddess whom the Greeks translated into Aphrodite

Urania, and identified with the *Alitta* of the Arabians, the *Myllitta* of the Assyrians, and the *Astarte* of the Phœnicians; thirdly, that this *Astarte* or *Myllitta* was a goddess of the heavens (*Urania*), or better, of the heavenly bodies, and, though the details are unknown, doubtless personified the harmony of their movements while controlling their supposed influence on human affairs, not least their influence on the sea, in which respect her worship would commend itself to a seafaring and trading people like the Phœnicians. As the universal goddess of love, her province embraced every phase of nature. While this, which was the basis of the character of *Astarte*, was the basis also of the character of *Aphrodite*; and while, through commercial ascendancy, the alphabet of the Phœnicians, and their system of numbers, weights, and measures were adopted by the Greeks, there is nothing in the way of assuming that the idea of their goddess *Aphrodite* was borrowed under similar circumstances. From being the goddess of beauty and love throughout nature, she became goddess of love in the hearts of gods and men; either inspiring a passion for herself, as in the case of *Pygmalion* and *Anchises*, or herself inflamed with love, as for *Adonis* and *Cinyras*, the reputed founder of her worship in Cyprus; or again inspiring a passion between two other persons, as between *Paris* and *Helena*, and between *Phaon* and the women of *Lesbos*. When the subjects were women, her power was frequently carried to a desperate issue, as in the cases of *Medea*, *Pasiphaë*, *Phædra*, and many others. But she gave also the pleasures of love, and while this led to the degradation of her character finally, it was differently viewed in earlier times, in which she was in this matter simply the goddess of domestic life and of the relations between families, being in some places associated with *Eileithyia*, the goddess of childbirth, or elsewhere regarded, like *Artemis*, as a guardian of children and young maidens.

APICIUS. There were three Romans of this name, all celebrated as epicures. The second, *M. Gabius Apicius*, who lived under *Tiberius*, is the most famous. He invented various cakes and sauces which bore his name, and rival schools of cookery claimed their descent from him.

APION, a Greek grammarian and commentator upon *Homer*, son of *Posidonius*, was born at *Oasis* in *Libya*, but called himself a native of *Alexandria*, where he studied. He taught rhetoric at *Rome* about 30 A.D. With extensive knowledge and great oratorical power he combined an unbounded vanity, as the epithet *cymbalum mundi* applied to him by *Tiberius* seems to imply.

APIS, a sacred bull worshipped at *Memphis* from the earliest period, having probably been introduced into the religious system as early as the 2d dynasty by the king *Kaiechos*, who instituted the worship of *Apis* and the bull *Mnevis*. His name in hieroglyphs was *Hapi*, and meant "the hidden," as he had to be discovered amidst the cattle, which was done by certain diacritical marks. According to the hieroglyphic inscriptions which accompany his form, he was the second birth or living incarnation of the god *Ptah*, the Egyptian *Hephestos* or *Vulcan*. *Apis* is first mentioned and appears in the monuments of the 4th dynasty. The two bulls *Apis* and *Mnevis* are considered to have respectively represented the moon and sun, and seem both to have been buried at *Memphis*. He was supposed to have been born of a virgin cow, rendered pregnant by a moonbeam or a flash of lightning. The mother of *Apis*, according to *Strabo*, had a part of the temple of *Apis* reserved for her use; and the hieroglyphic inscriptions record a prophet or priest attached to her service.

On the monuments she shares the honors of the bull, and is represented under the attributes of Athor as a goddess with a cow's head. This cow had her especial name, these animals having each a separate appellation. According to the Greek writers Apis was the image of Osiris, and worshipped because Osiris was supposed to have passed into a bull, and to have been soon after manifested by a succession of these animals. The hieroglyphic inscriptions identify the Apis with Osiris, adorned with horns or the head of a bull, and unite the two names as Hapi-Or, or Apis Osiris. According to this view the Apis was the incarnation of Osiris manifested in the shape of a bull. On the announcement of the birth of an Apis, the sacred scribes and priests proceeded to verify the characters of the calf. The marks of the Apis were a black colored hide, with a white triangular spot on the forehead. The day of his birth was kept as an annual festival. His life was not allowed to exceed 25 years, and should it have attained the maximum reckoned from the date of his enthronisation, the Apis was killed and thrown into a well, in which the priests asserted he had precipitated himself. The Apis was embalmed at great cost, but the operation consisted in preparing with bitumen the skull and a few of the principal bones of the bull made up into an appropriate shape. The second genius of the Karneter, or Egyptian Hades, was also called Hapi or Apis, but he was quite distinct from the bull god and the son of Osiris. His type was that of a human mummy with the head of a Cynocephalus ape. Bronze native figures of the Apis are not uncommon, and those of stone are occasionally found, but porcelain ones are extremely rare.

APOCALYPSE, a designation under which the last book of the New Testament is frequently referred to. See REVELATION of ST. JOHN. The name is applied generally to predictions relating to the growth and triumphs of the Messiah's kingdom, especially as revealed in visions or expressed by means of symbols. The more important extra-biblical writings of this kind are noticed in the article which immediately follows.

APOCALYPTIC LITERATURE. This branch of later Jewish literature took its rise after the older prophecy had ceased, when Israel suffered sorely from Syrian and Roman oppression. Its object was to encourage and comfort the people by holding forth the speedy restoration of the Davidic kingdom of Messiah. Attaching itself to the national hope, it proclaimed the impending of a glorious future, in which Israel, freed from her enemies, should enjoy a peaceful and prosperous life under her long wished for Deliverer. The old prophets became the vehicle of these utterances. Revelations sketching the history of Israel and of heathenism are put into their mouths. The prophecies take the form of symbolical images and marvellous visions. As the old remained unfulfilled in the progress of events, and doubts arose about their truthfulness, it was necessary to give them a new turn and a more correct interpretation. Working in this fashion upon the basis of well-known writings, imitating their style, and artificially reproducing their substance, the authors naturally adopted the anonymous. The difficulty was increased by their having to paint as future, events actually near, and to fit the manifestation of a personal Messiah into the history of the times. Hence apocalypists employed obscure symbols and mysterious pictures, veiling the meaning that it might not be readily seen. The artificial imitative character of their productions caused certain peculiarities; and the main object was attained by fastening the spirit of their contemporaries on the immediate fulfilment of their highest aspirations. From the intentionally dark imagery enfolding the ideas, it is difficult to

discover the exact times of their appearance and the historical interpretation.

The earliest of such apocalypses is the canonical book of Daniel, in which an old seer in the Chaldean captivity is employed to portray the oppression of the Jews under Antiochus Epiphanes. This was the model for all later ones. The literature in question was not confined to the Jews. Christians not only used the productions in which the Messiah was described after the Jewish fashion, but composed similar ones themselves—Jewish Christians in particular. Here the Apocalypse of John is the noblest example, and deserves the honor of naming the entire range of literature.

The most obvious division of apocalyptic works is that founded upon authorship, Jewish or Christian. This, however, cannot be carried out with exactness because of later interpolations, proceeding from Christians who used the Jewish prophecies with the object of making them more suitable. But it is not easy to trace the extent of subsequent elaborations; and we have only to rely on probable conjecture.

I. JEWISH APOCALYPTIC.

1. *Enoch*.—Under the name of this antediluvian patriarch a book exists which is quoted in the epistle of Jude. After it had disappeared, except the fragments preserved by ecclesiastical writers, it was found in Ethiopia among the Abyssinians, and published in 1821; subsequently by Dillman in 1851, to which the latter scholar added a German translation in 1853.

The work contains much curious matter about the secrets and powers both of the visible and invisible world. Besides its historical views which relate mainly to the past, present and future of the Jewish people, as also to heathen kings and potentates, much of the legendary and hagadic is interspersed. Daniel's seventy weeks, reaching down to the Messianic age, are changed into seventy periods of heathen rulers. The writer has withal a religious spirit. He is a strict moralist, warning and threatening. His imagination is vivid, but incapable of sublimity. The sweep of his prophetic vision is extensive. He has poetic force and vigor.

2. Another apocalyptic production is the so-called *Fourth Book of Esdras*, or *The Prophecy of Ezra*, originally written in Greek, but known now only in versions—Latin, Ethiopic, Syriac, Arabic, and Armenian. The whole consists of a series of visions, which Ezra, who is put unchronologically into the 30th year of the Babylonian captivity, is supposed to have had.

The poetic excellence of this production is much greater than that of Enoch. It is, indeed, below the Apocalypse of Daniel; but its merit is considerable.

3. *The Book of the Jubilees, or the Little Genesis*. ἡ λεπτή γένεσις, *parva Genesis*.—This work is apocalyptic only in part, though called the Apocalypse of Moses in the notices of it by George Syncellus and George Cedrenus. In the form of a revelation made to Moses during his stay on Mount Sinai, it professes to be intended for future races, and to contain prophetic admonitions relating to coming times. It is predominantly historical and chronological, beginning with the old histories of the creation. From the commencement of the world till the entrance into Canaan is divided into 50 jubilee years; and every event is arranged according to jubilees, years of weeks, and years. The author was an energetic Palestinian Jew, conversant with the history of his people, and conservative, who meant to confirm them in attachment to the faith, by narrating their past fortunes over again, and keeping them alive to their principles.

The Life of Adam seems to have been identical with the book of Jubilees, or perhaps a part of it. If the

latter it may have been another recension, enlarged and modified in various respects.

The *Book of Adam's Daughters*, mentioned in Gelasius's decree about authentic and apocryphal books, also appears to be the same as the Jubilees.

4. *The Assumption or Ascension of Moses* is a prophecy of the future relating to Israel, put into the mouth of Moses, and addressed to Joshua just before the great lawgiver died. Founded upon the book of Deuteronomy, it is brief and unpoetical. But it seems to have been large at first, for according to Nicephorus it consisted of 1400 stichs, while the Jubilees had only 1100. The work is an appropriate sequel to the Jubilees, but it seems to have proceeded from a different writer, though he lived at the same time. Internal evidence points to its composition after the death of Herod the Great, and before the destruction of Jerusalem.

5. *Apocalypse of Moses* contains an account of the formation of Adam and Eve, their fall, Seth's dialogue with his mother about Adam, and the disposal of the latter's body beside that of Abel. The *revelation* is said to have been made to Moses when he received the tables of the law and was instructed by the archangel Michael.

6. *The Sibyllines*.—Under this general name there exists a collection of oracles said to proceed from the sibyl in which Jewish ideas are promulgated and recommended to the Gentiles. The contents, however, are of a mixed character. Instead of a connected whole written by one person at a specific time, we have a heterogeneous assemblage of materials, Jewish, Christian, and heathen, of earlier and later origin, which must be separated and sifted before they can be assigned to their respective origins.

7. *The Apocalypse of Baruch*.—In this rhetorical production Baruch receives revelations respecting the future of Israel. Though Jerusalem has been destroyed by the Romans, and the calamities of the chosen people seem excessive, the prophet is comforted with the hope of better times, since the Messiah will come shortly to set up his kingdom after the Roman one has been destroyed. Then will be the judgment and the consummation; sinners will be punished, and the righteous rewarded.

II. CHRISTIAN APOCALYPTIC.

Christians followed the example of the Jews in using the sibyl as a vehicle of their ideas. Besides referring to the past, which they did mainly with reference to the person and work of Jesus Christ, they looked forward to the destruction of the world-power, and the consummation of all things at the second coming of Christ. They employed to a considerable extent both Jewish and heathen documents, interpolating or modifying them not very strongly. Often content with non-Christian sources, they adapted them but slightly, so that the ideas peculiar to Christianity shine forth dimly. The prophetic form of the Apocalypse does not demand the enunciation of doctrine, but rather a general indication of historic events, or the threatening announcement of destruction to the enemies of God. It deals with the utterance of principles exemplified by kingdoms and their rulers.

1. *The Apocalypse of Esdras*.—This Greek production resembles the more ancient fourth book of Esdras in some respects. The prophet is perplexed about the mysteries of life, and questions God respecting them. The punishment of the wicked especially occupies his thoughts. Since they have sinned in consequence of Adam's fall, their fate is considered worse than that of the irrational creation. The description of the tortures suffered in the infernal regions is tolerably minute. At last the prophet consents to give up his spirit to God who has prepared for him a crown of

immortality. The composition is feeble and tame, a poor imitation of the ancient Jewish one.

2. *The Apocalypse of Paul*.—This work contains a description of the things which the apostle saw in heaven and hell. The narratives descend to minute particulars, and possess no force or poetic power. Imitated from the Revelations of St. John, their great inferiority is apparent. Internal evidence assigns it to the time of Theodosius, *i.e.*, about 390 A.D. Where the author lived is uncertain.

3. *The Apocalypse of John* contains a description of the future state, the general resurrection, and judgment, with an account of the punishment of the wicked, as well as the bliss of the righteous. It appears to be the work of a Jewish Christian, for the bodily appearance of Antichrist is derived from Jewish sources; and there are numerous quotations from the Old Testament, especially from David. The date is late, for the writer speaks of "the venerable and holy images," as well as "the glorious and precious crosses and the sacred things of the churches," which points to the 5th century, when such things were first introduced into churches.

4. *The Apocalypse of Peter* contains a narrative of events from the foundation of the world till the second advent of Christ. The book is said to have been written by Clement, Peter's disciple.

5. *The Revelations of Bartholomew*.—In the year 1835, Dulauri published from a Parisian MS., subjoining a French translation, what is termed a fragment of the apocryphal Revelations of St. Bartholomew, and of the history of the religious communities founded by St. Pachomius. The late date of the production is obvious.

6. *The Apocalypse of Mary*, containing her descent into hell, is not published entire, but only several portions of it from Greek MSS. in different libraries.

7. *The Apocalypse of Daniel* has been published only in part (a little more than the half). The date of the document is determined by the monarch going to Jerusalem to deliver up his kingdom to God, and being succeeded by his four sons, who reside in different and distant cities.

8. *The Ascension and Vision of Isaiah*.—The first portion of the work called the Ascension of Isaiah in the Ethiopic text, gives an account of Isaiah's being put to death by the saw, under the reign and at the command of Manasseh. The prophet had had a vision respecting Christ, His crucifixion and ascension, as well as of the general apostacy which should take place in the early churches, of the descent of Berial in the form of a matricidal king, the duration of his reign, the descent of the Lord from heaven to destroy the wicked, and cast the ungodly into the fire. For this vision and prophecy Isaiah is condemned, and dies the death of a martyr (chapters i.-v.) The second part (chapters vi.-xi.) is essentially the same as Isaiah's vision in iii. 14-iv. 22.

9. *The Shepherd of Hermas*.—This production belongs in a certain sense to the present class of writings, and is usually reckoned among the apostolic fathers. It is not, however, apocalyptic in the proper acceptation of the epithet, because it wants the form. The apocalyptic idea has a different phase. The same remark applies to—

10. *The Testaments of the Twelve Patriarchs*.

Many apocalyptic writings, both Jewish and Christian, are mentioned in ancient works of which nothing is now known. Time has swept them away beyond recovery. It would be useless to collect the scattered notices of them.

APOCRYPHA. This term is a Greek word meaning *hidden, secret*. It occurs, for example, in Col. ii.

3, "In whom are hid all the treasures of wisdom and knowledge," and elsewhere in the New Testament. It is first found applied to writings in Clemens Alexandrinus, *Stromata*, iii. c. 4. When applied to writings the name may be supposed to have first expressed the nature of their contents; the writings were *secret*, embodying an esoteric teaching, profounder than that contained in the ordinary books of the system, and unknown to the ordinary people who professed it. Such writings were held to exist in connection with almost all the ancient systems of religion.

From the nature of the case, the same word might very well describe such writings further, either in respect of their *use* or in respect of their *origin*. In use these writings were, of course, like the doctrines they contained, both private and secret; they were not read in general meetings, and did not belong to the publicly recognised books of the system. Only some were admitted to the knowledge of them. That which formed the subject of public reference and instruction was the general doctrines of the system, while these peculiar and more recondite works were at most brought forward on rare occasions. And naturally the same secrecy which hung over their use generally also shrouded their origin. In some cases this might be a real mystery; the books were sometimes of ancient and uncertain date, and their authorship unknown. But oftener the mystery was fictitious, created for the purpose of securing respect for the doctrines inculcated in the writings, which themselves were forgeries of very recent times. Works of this kind were of very common occurrence in the East during the centuries immediately preceding and following the birth of Christ. In order successfully to float them and give them impulse, they were generally launched under some ancient and famous name; and books existed, claiming to be the productions of almost every renowned patriarch or sage from Adam downwards. Even when sent out anonymously, and of an historical rather than a doctrinal character, the scene of their narratives was laid in far back times, and famous personages were introduced acting and speaking, the design being to recommend to the living generation the conduct pursued or the sentiments expressed by the ancient hero or saint.

The term *Apocrypha* appears in this way to have passed through several stages of meaning, and from expressing a meaning good, or at least neutral, it came at last to have a very bad sense, differing very little from *spurious*. From the use of the word in ancient writers it does not appear that this progress from a good or indifferent to a bad sense was a matter of time, for the indifferent and bad meanings of the word seem to have existed side by side. Some ecclesiastical writers divide the sacred books into three classes—recognising first, some that are canonical; second, some that are not canonical, but of inferior value, profitable to be read for moral uses, but not to be founded on for doctrine—to this class the name *ecclesiastical* was sometimes given; and third, some that are apocryphal. Other writers know of only two classes, embracing both the second and third classes of the former division under the name apocryphal. This difference indicates a milder and a severer use of the term.

APOCRYPHA OF THE OLD TESTAMENT.—The books bearing this name are not contained in the Jewish or Palestinian Canon, *i.e.*, in the Hebrew Bible, but in the Alexandrian Canon, *i.e.*, in the Greek translation known as the Septuagint. Considerable obscurity hangs over the date and the circumstances of the close of the Hebrew Canon, and the principles which guided the collectors in their selection of books to be embodied. It is most probable that the *three* divisions referred to in the New Testament, of law, prophets, and writings

(Psalms) are of ancient origin; that the first two divisions were closed while prophetic men were still living, that is, considerably anterior to the close of the Persian period, while the third still remained open; and that at whatever time the third was closed, the books added to it were added under the impression that they were books composed before the succession of Prophets had ceased.

With the Greek or Alexandrian Canon the case was very different. This was, properly speaking, not an ecclesiastical, but a literary collection at first, for the tradition that it was commenced under the auspices of Ptolemy Philadelphus cannot be altogether set aside. At first only the books of Moses and perhaps Joshua were translated, the interest felt in the book being confined to the law. Only gradually and at intervals other books were added, for the translations are not only by different hands, but of very different dates.

The following books form the Apocrypha of the English Bible. They are given in the order in which they stand there:—1. I. Esdras. 2. II. Esdras. 3. Tobit. 4. Judith. 5. The additions to the Book of Esther. 6. The Wisdom of Solomon. 7. The Wisdom of Jesus, the son of Sirach, or Ecclesiasticus. 8. Baruch. 9. The Song of the Three Holy Children. 10. The History of Susanna. 11. The History of the Destruction of Bel and the Dragon. 12. The Prayer of Manasses, king of Judah. 13. The First Book of Maccabees. 14. The Second Book of Maccabees.

A few statements may be made regarding the general characteristics of the Apocrypha.

1. These books are of very great interest and value as a reflection of the condition of the fragments of the scattered nation, and of the feelings and aspirations which they cherished for a period of several hundred years, and in all the chief countries of the world. Some of the books, such for example as *Tobit*, belong to the Persian period, and were composed in the East, in Babylon or Persia, and describe the external life as well as the feelings and hopes of the exiles there; others arose in Palestine, such as *Ecclesiasticus*, and reflect the condition of life and the shades of religious speculation in the home country; while others, such as the *Wisdom of Solomon*, originated in Egypt, and afford means of estimating the influence of Greek thought upon the native doctrines of the Old Testament; and perhaps in the *2d Esdras* there may even be detected traces of Christian influence. The broad undivided stream of Old Testament doctrine and hope breaks at the era of which we are speaking into three channels. The largest, and that which best preserves its primary direction, continues to run in Palestine, diverging to some extent, and widening under the contributions which time and a very chequered experience and reflection made to it; while on each side of this another runs, one on the east and one on the west, directed and partly fed by the ideas of Persia and Greece respectively. To a certain extent the streams unite further on, and pour their united contributions into the great sea of Christian thought. The central stream is, of course, the most interesting, although to estimate it properly the books of the English Apocrypha are quite insufficient, other works belonging to the same region must also be taken into account, such as the great *Book of Enoch*, and several more. The two collateral currents are also of extreme interest, although it is far from easy to analyse their waters, and say with assurance what elements belong to the primary Old Testament sources and what are local contributions. Many have discovered traces of Persian ideas even in the canonical books of the Old Testament, particularly in the doctrine of angels in the later books, but the trustworthiness of such discoveries may be very fairly ques-

tioned. At the same time, there either is, in the book of *Tobit*, an advance absolutely on the Old Testament doctrine of angels and demons, or there are traces of a method of interpreting the history in Gen. ch. vi., and a carrying out of the method to further consequences, which are both unknown to the canonical Scriptures. And if in the Alexandrian *Wisdom of Solomon* a progress directly in advance of what is found in Prov. viii., on the doctrine of *Wisdom*, may be justly contested, there is certainly what may be called a progress round about, the ideas about *Wisdom* are expanded and placed in new lights, and made to enter into new relations, in such a way that a general approximation to the New Testament doctrine of the Logos was the result. But in general as a means of estimating the changing shades of feeling, the rise and fall of hopes, or rather the steady glow of a hope which no hardship could extinguish, the efforts to accommodate faith to circumstances and hold it fast in spite of all that was against it, in a word, as a means of estimating the inner life of a most interesting people in the very crisis of their history, the apocryphal books are invaluable. No more beautiful picture of piety or disinterested benevolence and patriotic warmth could be seen than is presented in the book of *Tobit*; neither could religious zeal and courage, even most reckless, patriotism, easily find higher expression than in the first book of *Maccabees*, or even in the unhistorical tale of *Judith*; while the under current of observant thoughtfulness, that contemplates but hardly mixes in life, runs in a deep if calm and passionless stream in the proverbs of the Son of Sirach. At no time was the nation idle. A people that had conceived such hopes, hopes which at last culminated in Christianity, could not be idle or less than restless and turbulent. There is no form of deed celebrated in the ancient history of the people that they did not try to reproduce, and no form of literary composition which, in those mournful centuries so full of oppression, they did not strive to imitate, with an inextinguishable life and hopefulness. This last fact, perhaps, might furnish the means of a classification of the books different from that suggested above, and similar to the division usually adopted in the Old Testament Scriptures. (1.) Historical, such as 1st *Maccabees*, although most that assume the historical form, such as *Judith*, are simple romances, and can be used only as an index of ideas and feelings, not in proof of facts; while others, like *Bel and the Dragon*, are completely fabulous. (2.) Prophetic, such as *Baruch* and 2d *Esdras*. In these the religious hopes of the people are most fully exhibited; for example, the Messianic expectations. Fully to understand these, however, other works, such as the book of Enoch, not contained in the recognized Apocrypha, have to be included. The prophetic literature almost always assumes the form called apocalyptic. (3.) Philosophical, or books coming under the Hebrew name of *Wisdom*. Here belong the *Son of Sirach*, the *Wisdom of Solomon*, to which must be added others not included in the English Apocrypha—e. g., the *Psalter of Solomon* and 4th *Maccabees*.

The degree of estimation in which the apocryphal books have been held in the church have varied much according to place and time. As they stood in the Septuagint or Greek Canon, along with the other books, and with no marks of distinction, they were practically employed by the Greek fathers in the same way as the other books; hence Origen, Clement, and others, often cite them as "Scripture," "divine Scripture," "inspired," and the like. On the other hand, teachers connected with Palestine, and familiar with the Hebrew Canon, rigidly exclude all but the books contained there.

Somewhat bitter controversies have raged over the Apocrypha in recent times. One was carried on in Scotland in 1825 and following years, which had the effect of inducing the British and Foreign Bible Society to employ its funds for the circulation of the canonical Scriptures only.

APOCRYPHAL BOOKS OF THE NEW TESTAMENT.—These may be divided into two classes—those books which were actually held as inspired by some portion of the Christian church, and those which were never acknowledged as canonical. Among the first are some of the writings ascribed to the apostolical fathers. The First Epistle of Clement was read in the churches, is quoted in the same manner as Scripture by Irenæus, and is found in the Codex Alexandrinus. The Pastor of Hermas was also read in the churches, is mentioned as inspired by Irenæus, Clemens Alexandrinus, and Origen, and is found in the Codex Sinaiticus. Somewhat similar respect was paid to the Epistle of Polycarp and the Epistle of Barnabas. Besides these books there were different gospels in use in the early period of Christianity. The most famous of these was the Gospel according to the Hebrews. Some critics regard it as the earliest gospel of which we know anything. We know very little more of the other gospels and apocryphal books than their names. Eusebius mentions the Acts of Peter, the Preaching of Peter, and the Revelation of Peter; the Acts of Paul, and the Doctrines of the Apostles. Origen mentions also the Gospel according to the Egyptians, the Gospel of Basilides and the Gospel according to Thomas, and according to Matthias. All these works have perished, and criticism can only conjecture, from a few scattered hints and fragments, what was their nature. The other set of apocryphal books consists of works that have come down to us relating to Christ and his apostles, but which were never regarded as inspired by any sect.

APOLDA, a town of Germany in the grand-duchy of Saxe Weimar, situated near the river Ilm, 9 miles east of Weimar, with which it is connected by railway. Hoisery and cloth are the chief manufactures of the town, besides which it contains pin and button factories, and bell foundries. There are mineral springs in the neighborhood. Population, 10,507.

APOLLINARIS SIDONIUS, CAIUS SOLLIUS, an eminent Christian writer and bishop, was born in Lyons about 430 A. D. Belonging to a noble family he was educated under the best masters, and particularly excelled in poetry and polite literature. He married Papianilia, the daughter of Avitus, who was consul, and afterwards emperor, by whom he had three children. But Majorianus, in the year 457, having deprived Avitus of the empire, and taken the city of Lyons, Appollinaris fell into the hands of the enemy. The reputation of his learning led Majorianus to treat him with the greatest respect; in return for which Appollinaris composed a panegyric in his honor, which was so highly applauded that he had a statue erected to him at Rome, and was honored with the title of *Count*. In 467 the Emperor Anthemius rewarded him for the panegyric which he had written in honor of him, by raising him to the post of governor of Rome, and afterwards to the dignity of a patrician and senator. But he soon quitted these secular employments for the service of the church; and, in 472, was chosen to succeed Eparchius in the bishopric of Clermont. On the capture of that city by the Goths in 480 he was obliged to retire, as he had taken an active part in its defence; but he was soon restored by Evaric, king of the Goths, and continued to govern the church as before. He died 482 or 484 A. D.

APOLLINARIS, SULPICIUS, a learned grammarian of Carthage, lived in 2d century, under the Antonines.

APOLLO. The influence of the sun on nature in a country like Greece, either brightening the fields and cheering mankind, or scorching and destroying with a pestilence, or again dispelling the miasma collected from marshes by night, was taken by the Greeks to be under the control of a divine being, to whom they ascribed, on human analogy, a form and character in which were reflected their own sensations. That divine being they called Apollo, a name which applied to him in two ways, either as "the destroyer," or the "repeller of ills." Apellon is both the Doric and the old Roman form of his name. Under the frequent title of Phœbus, he was hailed as god of the streaming light of the sun. Next to its daily course, which, however, was under the guidance of a special subordinate deity, Helios, the most obvious and invariable phenomenon of the sun was its withdrawal in winter and return in summer, and accordingly on this was based one of the principal features in the character of the god, which was also recognised in annual festivals in his honor, and made more explicit by the myth, in which after his birth, amid the splendid summer light of Delos, he is carried off in a car drawn by swans to the fabulous region of the Hyperboreans, where the sun was believed to tarry during the winter. The other class of solar phenomena, being variable in their occurrence, appeared to be directed by a precarious will, and from this was evolved for Apollo the double character of a god possessed of power over the sun, and at the same time guided in the exercise of it by the conduct of mankind. Hence the prominence of expiatory offerings in the worship of a god whom no act of wrong escaped. By his knowledge of what transpired on earth and in the councils of Olympus, he was prepared to be the god of oracles, which threw light on the future and banished the monsters begotten of terror at its obscurity. From observing the jubilant voice of nature greeting the sunshine, it was an easy step to regard Apollo as the god of music; while again the function of a god of medicine was peculiarly appropriate to a deity who, if he destroyed life, also saved it. In many ways the sun gladdened the herdsman and favored his flock. Hence both Apollo and Helios (Sol) had sacred herds of cattle of their own, while the former when in exile on earth himself acted as a herdsman.

With his oracular power was associated his function as god of music (Citharedus), and leader of the Muses (Musagetes), in which capacity he caused Marsyas to be flayed alive because he had boasted superior skill in playing the flute, or again, caused the ears of Midas to grow long because he had decided in favor of Pan, who contended that the flute was a better instrument than the lyre. But that which brought Apollo most closely home to the hearts of the people was his character of a destroying but yet an appeasable god. Pestilence and death by an unseen cause, or in the beauty of youth, were traced to him, and to prevent doubt as to his having a good reason in each case, there were the myths which told how, for example, he sent a pestilence on the Greeks before Troy, because Chryseis, the daughter of his priest, was retained in captivity by Agamemnon; or again, how with the aid of his sister Artemis (Diana) he slew the children of Niobe, because she had boasted of their beauty. A typical instance of his causing death undesignedly is that of his favorite, the beautiful young Hyacinthus, who was killed by the disc (a symbol of the sun) which Apollo had thrown in play. In Rome the worship of Apollo was not introduced until 320 B.C., in which year the city had been visited with a pestilence. The most frequent symbols of Apollo are the bow and the lyre; the tripod, suggesting his oracular power; the laurel which was carried by penitents as well as worn by victors, and into which Daphne was changed for not

yielding to his love; the palm, the wolf, the deer, and the raven. In the ripe period of art Apollo appears in a form which seeks to combine manhood and eternal youth. His long hair is usually tied, like that of his sister Diana, in a large knot above his forehead. As leader of the Muses, he wears long ample drapery girt at the waist, his tresses falling on his shoulders.

APOLLO BELVIDERE, a marble statue of Apollo, found towards the end of the 15th century near Antium (*Capo d'Anso*), a favorite resort of Roman emperors. Julius II., while yet a cardinal, purchased it; and on becoming Pope allowed it to be placed, through Michael Angelo, in the Belvidere of the Vatican, whence it was taken by the French in 1797, but restored in 1815. The marble some believe to be Greek, though perhaps the best authorities call it Carrara. In any case the statue is not an original work, but a copy apparently from a very fine Greek statue of about the beginning of the 3rd century B.C., of which another copy has been identified in a bronze statuette now in St. Petersburg, known as the Strogano-Apollo. Lately also a marble head has been found at Rome, corresponding closely in measurement and in style, confirming what is suggested by the statue, viz., that the original was of bronze. From the bronze statuette it is found that the Apollo Belvidere held forward in his left hand, not a bow as was thought, but the *ægis*, in the attitude of spreading consternation among an enemy, as he did among Trojans, and it is usual to adopt as the occasion for the production of this statue the invasion of the Gauls, whom, in 278 B.C., the god drove in alarm from his sanctuary at Delphi. The extraordinary praise bestowed on it by Winckelmann secured for this statue a fame from which the discovery of true Greek sculptures since then has gradually detracted, to this extent, that even its original cannot now be placed in the best period of Greek art.

APOLLODORUS, a celebrated painter of Athens who lived about 408 B.C. From the improvements he introduced into the art of mingling colors, and the use he made of shading, he obtained the surname, *Σκιαγράφος*.

APOLLODORUS, an Athenian grammarian, son of Asclepiades, and disciple of Aristarchus, lived about 140 B.C. His most famous production is his *Bibliotheca*, which treats of the gods and the heroic age; and though the extant work is possibly only an abridgment by another hand of the original, it is of great value in mythological inquiries. The best edition is that of Heyne, 2 vols. 8vo, published in 1803.

APOLLODORUS (60–130 A.D.), an architect, born at Damascus, a favorite of Trajan, for whom he constructed the stone bridge over the Danube (104 A.D.), which was esteemed the most magnificent of all the works of that emperor. He also planned a gymnasium, a college, public baths, the Odeum, and the Forum Trajanum, within the city of Rome; and the triumphal arches at Beneventum and Ancona. The Trajan column in the centre of the Forum is celebrated as being the first triumphal monument of the kind, and the model of many others in different cities, as Paris, London, St. Petersburg, &c. On the elevation of Hadrian to the throne, Apollodorus was banished from Rome, and shortly afterwards, being charged with imaginary crimes, was put to death (Dion Cassius, lxi.)

APOLLONIA, the name, derived from the god Apollo, of several cities of antiquity. The most important are—1. An Illyrian city on the right bank of the Aous, which owed its foundation to the Corinthians and Corcyreans. It soon became a place of commercial prosperity, was at a later period regarded as of military importance, and towards the close of the Roman republic acquired fame as a seat of literature and philoso-

phy. It seems to have sunk with the rise of Aulon, and few remains of its ruins are to be found. 2. A Thracian city (afterwards Sozopolis, and now *Sizeboli*), colonised by the Milesians, and famous for its colossal statue of Apollo, which Lucullus removed to Rome. 3. The port of Cyrene (afterwards Sozusa, now *Marsa Sousa*), which at length outgrew the greatness of Cyrene itself, and has left ample evidence of its magnificence in the ruins of its public buildings. It was the birth-place of Eratosthenes, usually known as of Cyrene.

APOLLONIUS, surnamed *MOLO*, a distinguished Greek rhetorician, the instructor of Cæsar and Cicero. Born at Alabanda, he settled at Rhodes, and in the dictatorship of Sulla, was sent as ambassador from the Rhodians to Rome. He was the first Greek who addressed the senate without an interpreter. Cicero renewed his studies under him when he afterwards visited Rhodes on his return from Asia. The works of Apollonius have perished.—Another rhetorician of the same name, likewise a native of Alabanda, and an inhabitant of Rhodes, was surnamed *The Effeminate* ὁ Μαλακός. Both are mentioned by Cicero with high respect.—Cicero, *Brutus*, 89, 90, 91; *De Inv.* i. 56; *De Orat.* i. 17, 28; Quintil. iii. 1, § 16; xii. 6, § 7, &c.

APOLLONIUS, surnamed *DYSCOLUS* (Δυσκόλος,) or *The Crabbed*, was a native of Alexandria, and lived in the reigns of Hadrian and Antoninus Pius. He was the first systematic writer on grammar, and is styled by Priscian "*Grammaticorum Princeps*." Of his extant grammatical works the principal one is the treatise *On Syntax*, the best edition of which is that of Bekker, Berlin, 1817.

APOLLONIUS, a Greek epic poet, surnamed *RHOBIUS*, from his long residence in Rhodes, though he is supposed to have been a native of Alexandria.

APOLLONIUS of TRALLES and his brother TAURISCUS were sculptors of the famous Farnese Bull, a group representing Zethus and Amphiion tying the revengeful Dirce to the tail of a wild bull. This work is now at Naples. There were several other sculptors named Apollonius.

APOLLONIUS, a grammarian of Alexandria, author of a Homeric Lexicon, *Λεξεῖς Ὀμηρικαί*, which was first published by Villoison, in two vols. fol., at Paris, in 1773.

APOLLONIUS of PERGA (PERGÆUS), next to Archimedes the most illustrious of the ancient Greek geometers, was born probably about 250 B.C., and died during the reign of Ptolemy Philopator (222–205 B.C.), flourishing thus about forty years later than Archimedes. He studied at Alexandria under the successors of Euclid, and is one of the brightest ornaments of that famous mathematical school.

But a few of the mathematical works of Apollonius have escaped the ravages of time. Of the greater part we have merely the names and general description given by Pappus in his preface to book vii. of the *Mathematical Collections*. His treatise on the *Conic Sections* gained him the title of *The Great Geometer*, and is that by which his fame has been transmitted to modern times.

APOLLONIUS, surnamed *TYANÆUS*, a Pythagorean philosopher, born at Tyana, the capital of Cappadocia, shortly before the Christian era. According to his biographer Philostratus, he studied grammar and rhetoric at Tarsus under Euthydemus, but he soon left that gay and luxurious city for the quiet town of Ægæ in the vicinity, where he spent his time in the company of philosophers and priests within the temple of Æsculapius. Among these he met Euxenus, one of the followers of Pythagoras, and from him he learned with enthusiasm the doctrines of the Samian sage. While

yet a mere youth he renounced all the ordinary pleasure of life. Abjuring the use of flesh and wine, he lived on the simple fruits of the soil, wore no clothing but linen and no sandals on his feet, suffered his hair to grow, and slept on the hard ground. He strictly observed the Pythagorean penance of five years' silence, suffering often the most painful trials of his patience without a murmur. Philostratus relates so many wonderful stories of his hero—how on one occasion, for instance, he awed an excited populace to silence by the mere waving of his hands, how he performed many miracles with a word, and how he knew all tongues without ever having learned them—that some have questioned the very existence of Apollonius; while others, admitting with reason the fact of such ascetic having lived about this time, regard him as a compound of magician, impostor, and religious fanatic.

Apollonius is not to be looked upon as a shallow and vulgar impostor, though to influence men's minds he had recourse to artifices and pretensions unworthy of a true philosopher. With some of the spirit of a moral and religious reformer, he appears to have attempted, though vainly, to animate expiring paganism with a new and purer life.

APOLLOS, a Jew of Alexandria, who came to Ephesus during the absence of St. Paul at Jerusalem. Apollos was a learned man, "mighty in the Scriptures," and preached "boldly" in the synagogue the doctrine of a Messiah, knowing as yet "only the baptism of John." Aquila and Priscilla having heard him, instructed him more fully in the doctrines of the gospel. Some time after this he went to Corinth, and was there very useful in convincing the Jews out of the Scriptures that Jesus was the Christ. Thus he watered what St. Paul had planted in that city (1 Cor. iii. 6). The division of the church at Corinth, in which one of the parties called itself by his name, was not prompted by him, and did not disturb the friendly relations that existed between him and St. Paul. Apollos hearing that the apostle was at Ephesus, went to meet him, and declined to return to Corinth, though St. Paul "greatly desired" him to do so. St. Jerome says that Apollos was so dissatisfied with the division at Corinth, that he retired into Crete with Zenas, a doctor of the law; and that the schism having been healed by St. Paul's letter to the Corinthians, Apollos returned to the city, and became its bishop. Less probable traditions assign to him the bishopric of Duras, or Iconium in Phrygia, or Cæsarea.

APOLOGETICS is, properly speaking, the part of theology which vindicates the right of theology in general, and of Christian theology in particular, to exist as a science, and is occasioned by the presence of anti-theological and antichristian speculation. Apologetics is therefore the scientific representation of the grounds on which Christian theology, in so far as it is a part of human knowledge, rests and may be vindicated. So long as Christianity lies hid, as it were, in the mind of man or in the consciousness of the church, without assuming an external or objective form, so long as it remains only in the form of a force impelling men to action, so long as it is content to manifest itself on the active or practical side only, there is no great need of Apologetics; but whenever Christian dogmatics arise, whenever Christianity objectifies itself on its intellectual side, and begins to force its way into the circle of the sciences, its entrance is disputed, it has to face hostile criticism, and begins to form an apologetic.

Apologetics is therefore the logical antecedent but the historical consequent of dogmatics; it is the introduction to dogmatics, it prepares the way for it logically by justifying its claim to exist, but it actually comes after dogmatics in the history of the intellectual manifestation

of Christianity, because, as a matter of fact, men do not feel called in to justify Christian theology until it actually exists in a dogmatic form. Thus, Apologetics may be compared to psychology, and in some respects to dogmatics what psychology is to metaphysics. Just as psychology is the link between physics and metaphysics, just as in psychology the two spheres of impersonal and personal life touch each other, and the two sets of natural and spiritual laws are seen in conjoint action, so Apologetics lies between human and superhuman science, in it the two spheres of human life and revelation meet, and the various and different laws which regulate each adjust themselves to each other's varying action; and psychology, which is historically consequent to metaphysics, is logically its antecedent and introduction. The position of Apologetics necessarily gives it a somewhat changeable nature. All sciences change, but they do so according to an inward development of their own, and their change is so far orderly and progressive; but the course of Apologetics must always be more or less erratic, because it has to do with the varying relations of the two spheres of human life and revelation, and has to adjust itself afresh at each change in these relations. The special form, too, which Apologetics has for the most part assumed—a defence or vindication of Christianity—has made it more changeable. It has been compelled to change its front from time to time to meet the altered form of attack.

The first period, extending from the beginning of the 2d century to the end of the 5th, may be subdivided into two: (1.) From the beginning of the 2d to the beginning of the 3d century; and, (2.) From the beginning of the 3d to the end of the 5th. The first of these is marked by the writings of Justin Martyr, Athenagoras, Tertullian, and Minucius Felix. The two Apologies of Justin were directed, the one against the Jews, and the other against the pagans. In both he follows the same method of justifying the Christian religion from the charges which were then commonly brought against it, and then attacking his opponents severely. All the apologists of this age follow the same course, and we see from their writings that the common attacks upon Christianity were charges of atheism, immorality practised, at their Agapæ, the Thyestæan banquets, and the like. The second of these periods is marked by the writings of Origen, Arnobius, Lactantius, Eusebius, Cyril of Alexandria, Augustine. These names show the course that Apologetics was taking. It had raised itself far above the position of a mere defence against vulgar prejudice and polished sarcasm; and Origen, when he opposed Celsus, was giving a philosophical defence against a philosophical attack upon the principles which lay at the basis of Christianity. With Arnobius begins the study of Christian evidences; and he tries to show that Christianity is not merely probable, but certainly true; while Lactantius proceeds upon the idea that, if Christianity be only clearly understood, it must be accepted, that its best defence is a clear statement of the principles on which it rests. Eusebius, on the other hand, is the first of the learned apologists, and proves the truth of Christianity by an elaborate comparison between it and all that was best in the various systems which went before it, and so far prepared the way for it. Cyril opposes Julian as Origen had opposed Celsus. Julian had directed his attack against the claims of Christianity to universal dominion; he admitted that it was one form, but denied it was the only form of truth, and Cyril's defence is interesting, inasmuch as it is the first answer of the Christian apologist to the objections of the pure Theist. Augustine's great work, the *De Civitate Dei*, is apologetic in so far as it endeavors to show that Christianity and the church are the only ark

of safety in presence of the dissolution of the empire and human society which then seemed imminent.

The second period dates from the 6th to the middle of the 15th century. It embraces the growth, life, and decline of scholasticism. In this period there are no direct attacks upon Christianity, and so no direct defences of it; but still Apologetics, although for the most part absorbed into the sum of Christian doctrine, and recognisable only in the attempt to assimilate philosophy and theology, is to some extent visible in the jealous defence of particular doctrines against the attacks of Nominalism, and reveals itself more prominently in the attacks made by Christian theologians upon the Jewish and Mahometan religions.

The third period extends from the middle of the 15th to the middle of the 17th century. This was the age of the Renaissance and of the Reformation, an age of inquiry, doubt, and change. Along with the Reformation, keeping with it as long as it was merely destructive, and abandoning it as soon as it became constructive, was a spirit or tendency, best described by the term Humanism. The Humanists were men who were thoroughly imbued with the spirit of the old classical poets of Greece and Rome, and had imbibed many of the old pagan ideas with reference to Christianity. Humanism, which was at first learning revived, contained within it two tendencies which afterwards showed themselves hostile to Christianity: the first was embodied in literary criticism, and mainly displayed the antagonism between literature and dogma, while the other took the form of a pantheist philosophy, founded on the divinity of Nature.

The fourth period extends from the middle of the 17th to the end of the 18th century. During this period, anti-Christian speculation assumes distinct forms, and Apologetics undergoes corresponding changes. The English deism, which began with Lord Herbert of Cherbury and Hobbes, and ended with Hume, called forth an innumerable number of replies from Christian theologians, and the special nature of the attack then made upon Christianity still gives their special form to English works upon Apologetics. The general tone of English Deists was that there was no warrant for the mysteries in Christianity, for its superior morality, for its historical position and influence, and so English Apologetics has been mainly concerned with the doctrine of the *evidences* of Christianity; and the general line of argument commonly taken has been, that there is as much evidence for Christianity as for some ordinary set of opinions generally admitted. In the French scepticism, the principal charge made against Christianity was that it rested on imposture and was maintained by trickery. An attack of this kind is answered, not so much by special defence, as by a silent appeal to historical testimony and to the character of man, and it is not to be wondered at if the French Church has not produced any very valuable apologetic writings defending Christianity from the special attacks of this school. The German rationalism began with Lessing's publication of the *Wolfenbüttel Fragments*, and ended with Kant. In its earlier form it was little else than an importation of the ideas of the English Deists, but latterly it assumed a special form by upholding the authority of the *individual* reason. The replies to the ordinary arguments of the English Deists were very numerous, but do not deserve further notice. The authority of the individual reason may be vindicated, either in the province of criticism or in that of dogma; the one effort gave rise to the critical rationalism of Eichhorn and Paulus, and the other to the dogmatic rationalism of Wegscheider.

At the present time Apologetics seems to be in a transition state. Since the time of Kant the historical

method of investigation has become all powerful in almost every department of human knowledge, and at the present the chief attacks made upon the supernatural and unique character of the Christian religion and theology are based upon the comparative science of religions. It is held that the Christian religion is the highest and most perfect development to which the religious spirit of man has yet reached, but that it simply differs in degree of development from any other religion. It is said that the Christian theology contains, like all other theologies, a great many elements of truth, but that is simply a natural religion like any other. This mode of attack has not yet been thoroughly faced by Christian apologists, but it must be the work of the Apologetics of the future to vindicate the supernatural character of Christianity by arguments which are based upon historical investigation and comparison of the different religions of mankind.

APOLOGUE. This word was originally, in Greek and Latin, employed loosely for any kind of story, but has now become synonymous with *moral fable*. See **FABLE**.

APOPTHEGM, a short, sententious, instructive utterance, as "Knowledge is power," "True greatness always wills." Of such sayings Plutarch made a famous collection in his *Apophthegmata Laconica*, and the biblical book of Proverbs abounds with examples.

APOPLEXY, a term in medicine which, though now also employed with other significations, is commonly understood to apply to a fit of sudden insensibility occurring in connection with some diseased condition of the brain.

Apoplectic attacks vary both as regards their intensity and their attendant phenomena, but well-marked cases present the following symptoms: The person attacked becomes, more or less suddenly, deprived of consciousness and all power of voluntary motion. He lies as if in a deep sleep, with a flushed face, a slow pulse, stertorous breathing, accompanied with puffing of the cheeks during expiration, and with the pupils of the eyes insensible to light, and contracted or unequal. This state in many respects resembles the coma of narcotic poisoning, and is unfortunately too often mistaken by unskilled persons for alcoholic intoxication. The symptoms and history of the case, however, are usually sufficient to enable a medical man to form a correct diagnosis. In this condition of insensibility death may occur within a few hours, or there may be a gradual return to consciousness, in which case it is frequently observed that some trace of the attack remains in the form of paralysis of one side of the body, while occasionally there may also be noticed some impairment of the mental powers, pointing to damage done to the brain.

Although thus generally sudden in its onset, it is seldom that an attack of apoplexy occurs without some previous warning. Persistent headache of a dull throbbing character, a sense of fulness in the head, vomiting, giddiness, noises in the ears, slight confusion of the mind, and numbness of a limb or of one side of the body, are among the more important premonitory symptoms; and these may exist for a variable length of time before the fit comes on. Such symptoms, more particularly the association of them, when occurring in a person at or beyond middle life are to be regarded with anxiety, as indicating danger of an apoplectic seizure. Various morbid conditions of the brain are capable of giving rise to fits of apoplexy. Hence different forms of apoplexy have been described by medical writers, such as the *congestive*, where the cause appeared to lie in an engorgement of the blood-vessels of the brain and its membranes; and the *serous*, where sudden effusion of fluid into the ventricles or substance of the brain seemed

to have brought on a fit. But by far the most frequent and important occasion of apoplexy is hæmorrhage into the brain by the rupture of blood-vessels. Indeed, by many modern writers the term apoplexy is applied only to cases of cerebral hæmorrhage. The blood-vessels of the brain, like those in other parts of the body, are liable to undergo degenerate changes after middle life. These changes affect the minute capillaries, as well as the larger vessels, rendering their texture fragile, and at the same time impairing their function in carrying on the healthy nutrition of the brain. Hence, in the immediate vicinity of the diseased blood-vessels, the substance of the brain itself undergoes degeneration, and becomes softened. The capillary vessels having thus lost the natural support of the surrounding tissues, and being themselves weakened by disease affecting their walls, are liable to give way, and blood escapes into the brain. The hæmorrhage may be slight in amount and in parts of the brain where its presence gives rise to little disturbance, but where a large blood-vessel has ruptured, and more especially where the blood has been extravasated in or around the important structures at the base of the brain, the result is a fit of apoplexy as above described, and death not unfrequently follows within a short period. In favorable cases where a certain measure of recovery takes place, the effused blood undergoes gradual absorption, or becomes enveloped in a sort of capsule formed by the surrounding brain substance, and ceases to cause further disturbance. But even in such cases some degree of paralysis remains at least for a time. Moreover, the nutrition of the brain is so impaired as to render probable a recurrence of the hæmorrhage, and thus the danger to life, as is well known, increases with each successive attack.

From what has been above stated, it will be observed that apoplexy is to be regarded as a disease of advanced life. With respect to the treatment of apoplexy, it must be admitted that little can be done during the state of unconsciousness. The practice of blood-letting, once so common in this disease, is now almost entirely abandoned, although there are physicians who still recommend its employment, especially where the attack occurs in stout, plethoric persons. Where death appears to threaten from the failure of the heart's action, warm applications to the surface of the body, and, should there exist any power of swallowing, the cautious administration of stimulants, are to be recommended. The case must be anxiously watched, and symptoms treated as they arise. When consciousness returns, the utmost care and quietness are to be observed to prevent the occurrence of inflammatory action, so apt to be developed, as a result of hæmorrhage into the brain.

APOSTASY, denoting in classic Greek a defection or revolt from a military commander, is generally employed to describe a complete renunciation of the Christian faith. In the first centuries of the Christian era, apostasy was most commonly induced by persecution, and was indicated by some outward act, such as offering incense to a heathen deity or blaspheming the name of Christ. The Emperor Julian, who is known in history as The Apostate, abandoned Christianity for paganism soon after assuming the purple, though it is questionable whether he had ever really embraced the Christian faith.

APOSTLE (one who is sent forth) is in the New Testament, and in Christian literature, a technical term — apostle of Jesus Christ. It appears that the name was originally applied to the twelve disciples in reference to the special mission to preach and work miracles in Israel, on which our Lord sent them forth during His ministry on earth. Luke alone of the evangelists

uses the word in a technical sense out of connection with this mission. After the resurrection the eleven, who again become twelve by the election of Matthias in the room of Judas, are regularly designated apostles. The precise prerogative of the apostolate is not defined. The apostles themselves feel that their distinguishing qualification is their personal fellowship with Jesus through all his ministry, their main office to witness to the resurrection.

Of the history of the apostles we have almost no authentic knowledge beyond what is stated in the New Testament.

APOSTLES' CREED, one of the earliest and most generally accepted symbols of the Christian faith, so called from the fact that its authorship was attributed to the twelve apostles. see CREEDS.

APOSTOLIC or APOSTOLICAL, a name assumed at different times by various churches and sects on the ground of some special connection with the apostles.

APOSTOLIC CANONS. These are rules to regulate Christian life and the discipline and government of the Christian church, which, it is supposed, have come down to us from the apostles. The Apostolic Canons consist of a series of eighty-five rules, of which the first fifty are held to be the most important. These rules contain a tolerably complete directory for the guidance of the clergy in their daily life and usual round of duties. It is somewhat remarkable that the life of the ordinary layman is for the most part left unnoticed; four Canons only deal with the laity, the rest of them speak of the clerical life and that alone. The authority of these Canons varies in the Eastern and in the Western Church. The Eastern Church, following the guidance of John of Damascus, has received as authoritative the whole eighty-five, and makes them of equal authority with the Epistles of St. Paul, *i.e.*, acknowledges that they possess plenary authority. The Western Church has always hesitated to receive more than the first fifty, and has received them more on the recommendations of such distinguished popes as John II., Stephen III., and Urban II., than because of their own intrinsic value; and it was only when they were incorporated in the decretals that they obtained a real authority.

APOSTOLIC CONSTITUTIONS are a collection of eight books of directions and prescriptions on ecclesiastical and theological matters, for which apostolic origin and authority have frequently been claimed. It is probable that the first six books form the earliest part of the whole, and it is certain that they were known and quoted as a separate treatise; the seventh book was also separately known, and in many parts bears a curious resemblance to the Epistle of St. Barnabas; the eighth is also an independent work, and is more legislative than the others.

APOSTOLIC FATHERS. The apostolic fathers is a name given to certain writers in the earliest period of Christianity, who were believed to have been the disciples of the apostles, and to have had intercourse with them. Those generally included under the title are Clemens Romanus, Ignatius, Polycarp, Barnabas, and Hermas. Sometimes the name is extended to Papias of Hierapolis and the writer of the Epistle to Diognetus. A critical examination of the writings attributed to these men, and a critical sifting of the traditions which we have in relation to their history, bring out the circumstance that the name is unsuitable. Clemens Romanus, Barnabas, and Hermas were supposed to be persons mentioned in the New Testament; but criticism proves conclusively that this is a mistake in regard to Barnabas and Hermas, and possibly also in regard to Clemens. Polycarp, in all probability,

and according to the best testimony, had intercourse with apostles, but it was in his early youth; and his Letter belongs to a period considerably later than that of the apostles. The Epistles of Ignatius, as well as the personal history of that martyr, are involved in great obscurity, and critics differ widely in regard to both. At the same time, the writings assigned by most critics to these men with some degree of certainty belong to a very early age of Christianity. They are among the earliest utterances of the Christian faith which have come down to us. All of them are of the nature of occasional productions, with perhaps the exception of the Pastor of Her-nas. All of them breathe a spirit of deep piety. There is no attempt to formulate the truths of Christianity. There are very few references to the books of the New Testament, and very few quotations from them. All of them are written in Greek.

Clemens Romanus.—According to the statement of Irenæus, Clemens was the third bishop of the Roman Church; this seems to have been the tradition among the Greek writers. Very late fictions represented him as a martyr. Eusebius gives as the date of his episcopate from 93 to 101 A.D. The only writing which can in any satisfactory manner be ascribed to Clemens Romanus is an epistle from the Roman Church to the Corinthian. Quarrels had arisen in the Corinthian Church, most probably in the reign of Domitian, as to some of the office-bearers of the church. And the Roman Church sent a letter to the Corinthian Church urging it to pursue a peaceful course, to shun envy and jealousy, and to do all things in order. The writing of this letter is ascribed to Clemens by Dionysius, bishop of the Corinthian Church, in a letter to Soter, bishop of the Roman Church (166-174 A.D.), and all subsequent testimony is in favor of this authorship. The letter was found at the end of the Codex Alexandrinus. Its position there is in harmony with the circumstances noted by several of the ancients, that it was read in the churches on the Sunday. Clemens Alexandrinus also frequently quotes it as the work of the "Apostle Clemens," and the mode of quotation is such as to lead one to believe that he regarded it as Scripture, though some have maintained that he did not regard it as canonical. The genuineness of the epistle has been generally acknowledged. There is strong external testimony for it, and the internal evidence is at least not against it.

Ignatius.—The information we get in regard to Ignatius up till the time of Eusebius is exceedingly scanty. He is mentioned in the epistle of Polycarp. The birthday of the martyr (*i.e.*, the day of his martyrdom) was celebrated in the church of Antioch. Speeches were delivered in his praise. Wonderful stories were told of him. He was one of the children whom Christ took up in his arms and blessed. He introduced antiphonal chants into the service of the church, because he had seen a vision of angels praising God in antiphonal hymns. The details of his martyrdom are given in a document devoted to the purpose. Of this document there are eight forms; but one is generally believed to be better than the rest. This one states that Trajan, in the ninth year of his reign, was in Antioch, that Ignatius was brought before him, and that the emperor condemned the bishop to be sent to Rome, and to be exposed to the wild beasts.

Polycarp was bishop of Smyrna. The principal part of the information we have in regard to him is derived from Irenæus, and may be accepted with confidence. Irenæus knew Polycarp personally, and remembered how Polycarp "related his intercourse with John and the rest who had seen the Lord." The apostles ap-

pointed Polycarp a bishop of the church in Smyrna, and he remained there a long time teaching the truth. In the time of Anicetus, Polycarp came to Rome, and showed a strong spirit of love and charity, which was fully reciprocated by the Roman bishop. They differed in regard to the celebration of the day of pass-over, but their differences did not interfere with their love for each other. A special document describes the martyrdom of Polycarp. There are good reasons for doubting the minute accuracy of this work, but the main circumstances have the appearance of being true. A persecution had arisen in Smyrna against the Christians, and naturally a demand was made for Polycarp, the chief of the Christians. At first he fled, but finding that this was of no use, he allowed himself to be apprehended and brought back. He was led before the proconsul, and urged to swear by Cæsar and revile Christ. "Eighty and six years," said Polycarp, "have I served Him, and He has done me no ill, and how can I blaspheme my King who has saved me?" The multitude wished the Asiarch to expose the bishop to the lions, but the Asiarch refused, as the time for lions was over. So the people gathered wood and lighted a fire. And Polycarp was placed in the fire, and ultimately also stabbed. The date of his martyrdom has been matter of keen discussion. Eusebius fixed it at 166 A.D.

Barnabas.—There has come down to us a work called the *Epistle of Barnabas*. This work is unanimously ascribed to Barnabas, the companion of St. Paul, by early Christian writers. Clemens Alexandrinus quotes the letter seven times, and speaks of it as the work of the apostle Barnabas. Origen, Eusebius, and Jerome mention it. The internal evidence is conclusive against its genuineness.

Hermas.—The *Pastor Hermas* is one of the most interesting books of Christian antiquity. The name Hermas occurs several times in the work, and it was therefore natural for the ancients to suppose that this was the name of the author. The book at a very early period became widely known in the East, and was regarded as inspired. The work is fictitious in form, and there is no good reason for supposing that he has introduced any real characters into it. There is no clear indication of a date; but various circumstances lead to the inference that it was written towards the end of the reign of Hadrian, or the beginning of the reign of Antoninus Pius. Internal evidence points strongly to Italy as the place in which it was written. It was very popular with the ancient church, and deservedly so. It presents Christian truth in an attractive manner. Its tone is high and noble, and it breathes the spirit of the gospel of love.

APOSTOLICI, or APOSTOLIC BRETHREN, a name assumed by three different sects, which professed a close adherence to the doctrines and practice of the apostles. The earliest, known also as the *Apotactici*, were a branch of the Encratites, and came into existence in the 3d century. According to Epiphanius, their principles were communistic. The second sect of the name was formed in the district surrounding Cologne about the middle of the 12th century. Its members were zealous reformers, rejecting the authority of the Pope and the rites and ceremonies of the church. It is not certain that they absolutely rejected marriage, though they preferred celibacy. Founding on the authority of St. Paul, the celibates took spiritual sisters, with whom they lived in concubinage. Bernard of Clairvaux wrote against the sect, and some of its most prominent members being brought before the archbishop of Cologne were condemned to the flames. The third sect of Apostolici in chronological order was founded by Gerhard Segarelli, a mechanic of Parma, towards the close of the

13th century. Segarelli, who had sought admission unsuccessfully to the Franciscan order, was much impressed, it is said, by a picture of the apostles which hung in the Franciscan chapel at Parma. Becoming convinced that the much-needed reform of the church could only be effected by a return to the apostolic practice, he sought to establish a community in which the life of the apostles should be imitated as closely as possible. By slow degrees he gathered a considerable number of followers, chiefly from the lower orders, who went about from place to place clad in white robes, with long beards, dishevelled hair, and bare heads, accompanied by women whom they called their spiritual sisters. Like the other two sects of the same name, they established a community of goods. Though their practice was thus peculiar, their doctrinal teaching did not for a considerable period seriously diverge from the orthodox standard. The arrest of their leader by the bishop of Parma (1280), and condemnatory decrees issued by Honorius IV. (1286) and Nicolas IV. (1290), changed their position into one of open hostility to the Church of Rome. Accepting the predictions of the Abbot Joachim of Flora, they looked for the downfall of the papacy, which they described as the Babylon of Scripture, and the establishment of a new and purer church upon its ruins. Segarelli was accused of heresy in 1294, but escaped for the time by recantation. In 1300, however, he was condemned as a relapsed heretic to the flames. His place was immediately taken by Dolcino of Novara, the natural son of a priest, under whom the sect became still larger and more formidable. He seems to have been a man of superior power to Segarelli in all respects, and especially to have had considerable talent as a military leader, having succeeded in carrying on a war for two years against Raynerius, bishop of Vercelli. In 1307 he was defeated, taken prisoner, and put to a cruel death at Vercelli. The name of "Dolcinists," frequently applied to the sect, marks the extent of Dolcino's influence, as does also an allusion to him in Dante's *Inferno*.

APOSTROPHE, is a rhetorical figure by which a speaker changes the course of his speech or turns away to address persons absent or present, the dead or inanimate objects, either invoking them as witnesses or to pity them, praise or condemn them. Apostrophe in grammar is the sign (') used to indicate the omission of a letter or letters as in can't, or as a sign of the possessive case as in boys', boy's.

APOSTOLIUS, MICHAEL, a Greek theologian and rhetorician of the fifteenth century, died in 1480.

APOTHECARY. This name is derived from a Greek word used by Galen to denote the repository where his medicines were kept. In Scotland the term is often applied to one who compounds and sells drugs, but this class is now defined in the language of some recent Act of Parliament as pharmaceutical chemists, and chemists and druggists, both in England and Scotland. In England the name indicates a general practitioner in medicine who supplies drugs to his patients. The Apothecaries' Society of London is one of the corporations of that city, and both by Royal Charters and Acts of Parliament exercises the power of granting licences to practice medicine. The members of this society do not possess and never have possessed any exclusive power to deal in or sell drugs; and until very lately (1868) any person whatever might open what is called a chemist's shop, and deal in drugs and poisons. In that year, however, the Pharmacy Act was passed, which prohibits any person from engaging in this business without being registered.

APOTHEOSIS, deification, the enrolment of a mortal among the gods. In its most rudimentary form,

this practice may be regarded as an offshoot of the universal belief of primitive mankind in the existence of disembodied spirits, and their continued agency in human affairs. An invisible being thus invested with beneficent or malefic attributes, and capable of being offended or propitiated, virtually becomes a local or tutelary divinity. The cultus of such genii constitutes a large part of the religion of most negro nations. In China it takes the shape of a respectful veneration of ancestors, accompanied by a species of liturgical service. In India it is apparently excluded by the tenet of incarnation, according to which the individual either resumes a rank previously held by him, or enters upon a cycle of transmigrations admitting of no fixity of condition and, consequently, of no absolute deification. The Egyptian, Persian and Phœnician theologies seem to offer no trace of the idea; but there is reason to expect that it will be shown to have been a leading feature of the religions of Assyria and Babylon. For perfectly unequivocal examples of its prevalence among a highly cultivated people, we must resort to Greece and Rome. In Greece the worship of deified heroes was universal. A distinction, however, must be observed between the imaginary patriarchs of the golden age, who, after their decease according to Hesiod, became by the counsel of Zeus beneficent dæmons, guardians of mortal men, but who seem to have enjoyed only a vague and general veneration, and the mythical heroes, definite objects of worship who may have been equally apocryphal, but whose legends were none the less regarded as authentic history. The reputed founders of cities were especially honored with sacrifices by their descendants, and the practice extended to such indubitably historical personages as Lycurgus, Brasidas, Harmodius, Aristogiton, and Ptolemy Lagus. Instances of the origination of such worship in the historical period are nevertheless rare, and the veneration paid to the hero was in all cases merely local. The religious honors subsequently bestowed in their lifetime on Lysander, Alexander the Great, and other illustrious persons, were merely the extravagance of flattery, devoid of any influence on the national theology. The same cannot be said of the apotheosis of the Cæsars, the germ of which already existed in the veneration paid to the state, long the object of his reverence. The people, says Suetonius, fully believed in the divinity of Julius Cæsar, hinting at the same time that this was by no means the case with the majority of the apotheoses subsequently decreed by the senate. (*Ful. Cæs. c. 88.*) The honor was indeed not only conferred upon almost every emperor who transmitted the sceptre to his descendants, but frequently upon deceased members of his family, or even his personal favorites, as in the case of Antinous. Sixty persons altogether are recorded as having been thus raised to divine honors from the time of Cæsar to that of Constantine.

APPALACHIAN MOUNTAINS, the general name given to a vast system of elevations in North America, partly in Canada, but mostly in the United States, extending for 1,300 miles, from Cape Gaspé, on the Gulf of St. Lawrence, south-west to Alabama. The whole system may be conveniently divided into three great sections: the *Northern*, from Cape Gaspé to New York; the *Central*, from New York to the valley of the New River; and the *Southern*, from the New River onwards. The first of these includes the Adirondacks, the Green Mountains, and the White Mountains, and the irregular elevations towards the north; the central contains a large portion of the Blue Ridge, the Alleghanies proper, and a great number of lesser ranges; and the southern consists of the prolongation of the Blue Ridge, the Black Mountains, the Smoky Mountains, and the Unaka

Mountains. The whole range, and especially the central portion, is remarkable for the parallelism of the various ridges, the uniform height of the summits in the same part of the chain, the absence of a central axis of elevation, and the presence, instead, of a central valley or axis of depression. The typical arrangement of the system—most distinctly visible in the central division—might be represented in diagram thus: first, a stretch of country, gradually sloping, with slight undulations and irregularities, upwards from the Atlantic, and attaining a height of 300, 500, or 1,000 feet; then, a lofty ridge rising like a rampart, and succeeded by other ridges separated from each other by longitudinal valleys; next, the great central valley or axis of depression; and lastly, a new succession of ridges breaking off into table-land, with transverse valleys and a gradual decrease of elevation. The Atlantic slope varies in breadth from 50 miles, as in New England, to 200 miles in the south, and in the neighborhood of New York has almost altogether subsided. The central valley may be traced from Lake Champlain in the north, along the course of the Hudson, down through the Cumberland Valley in Pennsylvania, and the Great Valley of Virginia and Tennessee; it varies in breadth from 15 miles in the north to 50 or 60 miles in the south. The elevation of the valley rises towards the south in keeping with the elevation of the neighboring ranges. None of the summits of the system reach the region of perpetual snow, but a large number of them attain a considerable altitude. In the Adirondacks the highest point, Mt. Tahawus or Mt. Marcy, reaches 5379 feet. In the White Mountains, Mt. Washington, in the main chain, has a height of 6288 feet; Mt. Adams, 5794; Mt. Madison, 5365; Mt. Jefferson, 5714; Mt. Clay, 5553; Mt. Monroe, 5384; Lafayette, 5290; and a great number of summits attain a height of more than 4000 feet. In the Green Mountains the highest point, Mt. Mansfield, is 4430 feet; Lincoln Mount, 4078; Killington Peak, 4221; Camel Hump, 4088; and a number of other heights upwards of 3000 feet. In the central division the hypsometric surveys are imperfect; but the general elevation of the higher chains is from 1000 to 2500 feet. As we approach the south, the complexity of the system and the altitude of the individual mountains increase together, and the chains which have run parallel and distinct begin, as it were, to gather and fold themselves into an irregular coil. The peaks of Otter in Virginia are about 4000 feet high; and in the Black Mountains, the Black Dome (Clingmann), which is the culminating point of the whole system, attains the height of 6707 feet; Balsam Cone (also known as Guyot, from the hypsometrical explorer of the region) has 6671; Black Brother, 6619; and Mt. Hallback (sugarloaf), 6403; besides a large number of summits varying from 3000 up to 6000 feet. In the Smoky Mountains we have Clingmann's Dome, 6660 feet high; Guyot (in Tennessee), 6636; Mt. Alexander, 6447; Mt. Leconte, 6612; Mt. Curtis, 6568; several others upwards of 6000, and a great many of more than 5000. In the whole Appalachian system, Lake Champlain is almost the only lake of any importance; but a multitude of rivers, and some of them of considerable size, find their sources in its recesses. The watershed does not lie along any one continuous axis, but shifts its position several times along the line. In the north it is found in a stretch of country, called the Height of Land, that lies between the White and the Green Mountains, and gives birth to the Connecticut and a number of smaller streams; next, it is formed by the Adirondack Mountains, which supply the sources of the Hudson River; and, further south, by the high plateaus of Pennsylvania and New York, which give origin to the Delaware and the Susquehanna, with their numerous tribu-

aries. These rivers, flowing south and east, have thus to cut their way through the successive ridges of the whole Appalachian range. The watershed is next situated in the Alleghanies proper, which send a number of affluents to the Ohio on the west, and give rise to the James River on the east; and lastly, it runs along the terminal cluster or coil composed of the Black, the Smoky, and the Unaka Mountains. Here a tributary of the Ohio, called the Red River, a number of the affluents of the Tennessee, and various less important streams, have their sources. The Appalachian Mountains are a vast storehouse of mineral wealth. Magnetite, hematite, limonite, and other iron ores, are found in great abundance. The first is best exhibited in what is frequently called the Champlain Iron District, where it is now largely manufactured; and it also attains remarkable development in various parts of New York and New Jersey. The extensive deposits of this ore in Virginia, North Carolina, and Georgia, have hitherto been turned to comparatively little account. It is frequently contaminated by phosphate of lime, sulphur, and titanium. Red hematite is found in New York, Pennsylvania, Tennessee, and Georgia, and is usually known as Clinton ore, from a place of that name in Madison County, New York, while in Tennessee it is called Dye-stone ore. It is of great commercial importance, though, on account of the amount of phosphorus which it contains, it is worthless for the manufacture of steel. Limonite, or brown hematite, which, from its fusible character, is usually worked along with the more crystalline ores, occurs in a series of beds all along the flanks of the Appalachians, from Maine in the north to Georgia in the South. The earthy carbonate of iron—"clay ironstone ore," "shell ore," "kidney ore,"—is found in most parts of the system in connection with the Carboniferous strata, and has been very largely manufactured. In the northern district alone—that is, in the eastern part of New York, in New Jersey, and Eastern Pennsylvania—the number of furnaces is about 200, and the gross production of iron 900,000 tons per annum, or one-third of the entire production of the United States. This abundance of ore would have been almost useless had it not been for the equally abundant supplies of fuel; and the coal measures are among the most extensive in the world, the bituminous coal alone covering an area of 56,000 square miles, without counting the unrivalled beds of anthracite in Pennsylvania and New York, which cover an area of between 400 and 500 miles. While the supply of gold, silver, copper, and lead is of comparatively no importance, marble, limestone, fire-clay, gypsum, and salt are extremely abundant. Many of the ranges are richly covered with forest, and yield large quantities of valuable timber, consisting chiefly of sugar maple, white birch, beech, and ash, in the north, and oak, cherry-tree, white poplar, white and yellow pine, towards the south. The dark foliage of the pines, balsam-firs, hemlock-trees, and cedars, gives color and name to many of the districts. Rhododendrons, kalmias, azaleas, and other flowering shrubs, often grow in almost impenetrable thickets; and in some parts the botanist is at once delighted and bewildered by the profusion and variety of the smaller plants. Bears, "panthers," wild cats, and wolves haunt the forests in large numbers.

APPARITIONS, in the ordinary acceptance of the word, can scarcely be better defined than in the terms used by Defoe: "They are the invisible inhabitants of the unknown world, affecting human shapes or other shapes, and showing themselves visibly to us." In this definition no account is taken of "spectral illusions, involuntarily generated, by means of which figures or forms, not present to the actual sense, are nevertheless

depicted with a vividness and intensity sufficient to create a temporary belief of their reality." Theories of apparitions generally deal with these hallucinations and no doubt they are the foundation of many of the stories of superstition, but they scarcely suffice to account for the universality of the belief in the possible appearance of disembodied spirits. These figures, kind or threatening, are probably the first objects that meet the vision of primitive men, when they begin to reflect on the unseen powers around them, and "to explore these coasts which our geographers cannot describe." Ghosts are almost the first guess of the savage, almost the last infirmity of the civilised imagination; on these forms, shadowy and unsubstantial as they are, solid superstructures of ritual and morality have been based, and apparitions, with the consequences of the belief in them, have a literature and a history of their own.

In the first place, the belief has had an immense effect on the religious and moral development of our race. Though it is as yet impossible to analyse to its first elements the confused mass of fear and custom which makes up the faith of savages, there can be little doubt that their religion, with the later and refined heathenism of Greece and Rome, sprang in part from the propitiation of the spirits of ancestors. Again, it would no longer be true to say, as Scott did forty years ago, that "the increasing civilisation of all well-constituted countries had blotted out the belief in apparitions." The visionaries who found their religion on a pretended intercourse with the dead, and who consider the highest function of their clergy to be "the serving of tables"—tables that rap and move—may be counted in America by millions. Many causes have combined to bring about this return to what a short time ago seemed a forlorn superstition. First, there was that reaction against the somewhat commonplace scepticism of the last century which took in literature the form of Romanticism and of the Gothic revival, and brought back in a poetical shape the fairies and spectres of mediæval fancy. Again, the lofty morality and pure life of Swedenborg (1688-1771) won a hearing for his extraordinary visions, and minds influenced by him were ready to welcome further additions to the marvellous. He declared that "the spirit of man is a form;" and added that it had been "given to him to converse with almost all the dead whom he had known in the life of the body." Last of all came what is called spiritualism, inspired by an impatient revolt against the supposed tendencies and conclusions of modern science. Inquirers who live in constant fear that science is trying to demonstrate the truth of materialism, and to rob them of their dearest hope, that of a future life in the society of their departed friends, turn eagerly to what they think ocular evidence of another existence. There is scarcely any literature, not even the records of trials for witchcraft, that is more sad and ludicrous than the accounts of "spiritual séances," with the persistence of the bereaved in seeking a sign. The attempt of the Alexandrian Platonists to substitute the visions of trances for the conclusions of intellect has been called the despair of reason; and modern spiritualism, when it is not a drawing-room amusement, is too often a moment in the despair of faith.

It would be rash to say, with Mr. Herbert Spencer, that the propitiation of the spirits of ancestors is the first germ of all religion, and it would be premature to deny that there may be races which have no conception of the existence of the spirit after death. But it is safe to assert that there are very few savage peoples who do not believe that their dead ancestors appear to them in dreams, and in what they think the clearer vision of trances, and who do not prove their belief by sacrifice of food, by prayers for help, by hymns, and by offerings

made to show love or deprecate anger. The widespread graves of extinct races, with the weapons and vessels buried along with the dead, demonstrate that these nameless and vanished hordes also held that the life of the dead persists, with its old needs and desires. The literature of cultivated peoples shows clearly that the Greeks and Romans held the same opinion, and practised no very different rites.

Taking it for proved that the credence in the apparitions and the power of the dead is a fact as good as universal in the beginning of thought, we must ask, How was the notion arrived at? Discarding for the moment the possibility that it was founded on actual apparitions, we observe several causes which might, indeed which *must*, have given rise to it. The savage, like the child, is full of questionings, and his reasonings, are, so to say, perfectly rational. His hypotheses colligate and explain the facts, as far as he knows them. One of the earliest mysteries to him is the mystery of death—how is he to explain the sudden and eternal stillness of the warriors slain in battle? Now the savage philosopher knows of another state, namely; sleep, in which he *seems* as quiet as the dead, but is really active in dreams. He has then two selves? "When I sleep," then the savage may conclude, "one of my selves leaves the other to rest, and goes about its business. And in death, also, one self flies away, but it will not return—it is homeless, hungry, wandering. Above all, its a very strange thing, and, as strange, to be feared." *A priori* reasoning goes as far as this, and then confirmatory facts support the hypothesis. In dreams he meets the dead warrior, and some of his friends have the same experience. And there is one of the tribe, the diviner or *shaman*, whose opinion they revere in these matters. He is thus described by a Zulu convert—"When he is awake he sees things which he would not see if he were not in a trance." He knows how to produce trances by fasting, by inhaling the smoke of herbs, and by the use of strange oils. He sees things before they happen, and tells how, when awake, he beheld the slain warrior, and promised to appease his hunger with sacrifice of cattle. There can scarcely be any other conclusion from these facts, as far as they are known to the savage, except that the dead yet live, and appear to the living, and keep their old passions and their old wants.

Now this belief in apparitions, thus stated, is capable of much development. The favorite ancestral spirit of the strongest tribe will tend to absorb the lion's share of sacrifice and hymns, and to become such a hero as Theseus was to the Athenians. Many other influences produce a still higher religion, a circle of Olympian gods, a philosophical and intellectual monotheism. The family of the seer will perhaps become a sacred caste, like the Eumolpidæ at Athens. An early civilisation is formed, with its philosophers, holding in secret a monotheism of their own, with its city population pleased by stately temples and hieratic splendors, but we must remember that all this time the *pagani*, the rural people of the hills and the coast, come very little under the influence of philosophy or ritual. They still retain the old dread of the ghosts of the departed, and still people the woods and wells with wandering spirits. As slaves and nurses they enter the cultivated families, their old wives' fables impress the awakening imagination of childhood, and the earliest of all forms of belief in the supernatural finds its way back into the circle of culture. At last there comes a time of decadence, when the abstract notion of Deity seems too vague and distant, when the Olympian gods are no longer credible, and philosophy falls back in despair on the traditional ghosts of the nursery and of the Oriental slaves. Thus Neo-

Platonism reinstated apparitions as demons, angels, powers; and thus Henry More and Joseph Glanvil combated the scepticism of the seventeenth century with stories of haunted houses, and of the mysterious drummer of Tedworth.

If this theory of the origin of the belief in apparitions be correct, it tends to explain what certainly is a difficulty—the *identity* of ghost stories in all lands and times, the conservatism of that great majority, the dead. For the further we go back in the history of civilization, as in the works of nature, the simpler, the more identical, the more widely diffused are all its productions. The earliest implements for lighting fires, the earliest weapons, are not more alike than the earliest guesses of speculation and the earliest efforts of fancy. These oldest fancies dream of apparitions of the dead, and are preserved below the level of advancing culture, and insinuated into the ideas of the cultivated classes by the classes which are unprogressive, unaffected on the whole by religious or social changes. It is for this reason that magical rites are everywhere the same, as M. Maury has observed—that the Scotch witch had the same spells as the Kaffir witch, that Balzac's description of a Parisian sorceress in *Le Cousin Pons* might serve as an account of a Finnish wise woman. It is not strange that superstition and ignorance should always tell the same baseless tale if they have always treasured and still repeat the earliest and crudest fancies of the race. Nothing shows more clearly the purity of ancient culture than the absence of superstition in the Greek: as compared with our Teutonic classics.

Supposing the origin of the belief in apparitions, and its identity in different peoples, to be thus accounted for, it remains to ask if the surviving forms of the creed can be traced back to a primitive source. In entering the cloudland of folk-lore it is impossible to advance too cautiously. This is a realm where nothing is fixed and definite; where all is vague, floating, confused. He who would call up and try the spirits here must not place himself within too narrow a magic circle, but extend his view as far as possible to the beliefs of the most alien and distant races. The apparitions of popular superstition fall into classes which always tend to be merged in each other, but which are not so indistinct that they cannot be considered apart. No form is better known than the belief in faeries. All over Europe fire-side tradition tells of women who haunt lonely places, where they are seen to dance, to spin, to comb their long hair. The forests sheltered them when the fane of Jupiter fell, and the house of Theseus became the church of St. George.

It would be easy to trace the belief in brownies (lubber spirits, who tend the house) to the lar, or hearth spirit of the ancients. The *domovoy*, or Russian brownie, "lives behind the stove; but he, or the spirits of the dead ancestors whom he represents, were held to be in even more direct relations with the fire on the hearth."

We now come to almost the most universally credited class of apparitions—namely, the subjective visions, coinciding with real facts and events occurring at a distance, beheld by persons possessing the gift of second-sight. The second-sight is described by a believer as "a singular faculty of seeing an otherwise invisible object without any previous means used by the person that beholds it for that end." The name of second-sight is the Scotch one under which the reputed phenomena excited the curiosity of Dr. Johnson, and "made him wish to have some instances of that faculty well authenticated." In Scott's opinion, "if force of evidence could authorise us to believe facts inconsistent with the general laws of nature, enough might be pro-

duced in favor of the existence of the second-sight." All history, all tradition, abounds in instances. A well known anecdote tells how St. Ambrose fell into a comatose state while celebrating the mass at Milan, and on his recovery declared that he had been present at St. Martin's funeral at Tours, where, indeed, reports from Tours afterwards declared that he had been seen.

The apparitions which play a part in all the records of trials for witchcraft admit of some explanation, though scarcely an adequate one, in known laws of human nature. It is easy enough to understand how in primitive times the diviner who beheld spirits was also believed to be able to command them to do his bidding and to injure his enemies. The belief persisted under the civilization of ancient Rome, and Apuleius tells a very impressive story of how the apparition of "a woman of hideous aspect, marked by guilt and extreme sorrow, whose haggard face was sallow as boxwood," was evoked by a witch to slay her foe. No instance of the survival of savage superstitions is stranger than the fact that men like Henry More and Glanvil, Bodin, the great French publicist, Sir Thomas Brown, and Wesley, could still maintain that disease and death might be caused by such malevolent apparitions. We can only say in their defence that the amount of concurrent evidence and confession, corresponding as it did with the prohibition of witchcraft in the Bible, constrained them to share the cruel superstition of their age.

The species of apparitions we have discussed may all be traced to the traditions of the non-progressive classes, and connected with the earliest ideas about the supernatural. But the spirits which are most familiar to us, the spectres of ghost stories and fireside tales, rest their claims to existence on the evidence of the eyes and ears of people we meet every day. True, the evidence is of the hearsay class; it is almost as rare to find a witness who has seen a ghost as to encounter a person who does not know some one who has had this experience. As a rule, the deceased friend is said to have appeared at the moment or about the time of his death to an acquaintance at a distance. The belief is now more widely spread and more firmly held among the educated classes than it has been for centuries, and the arguments on both sides are worth consideration. The sceptics do not deny that people have been subjectively affected in the same way as they would have been if a dead friend had been subjectively present. But they bring forward several well-authenticated instances to prove that some people have been subject to *illusory* appearances, of which they could only test the reality by the attempt to handle them. Perhaps the best known case is that of Nicolai, a Berlin bookseller (1790), who repeated his own hallucinations to the academy of Berlin.

A further explanation is given by Sir David Brewster, who has remarked as a physical fact that, "when the eye is not exposed to the impressions of external objects, or when it is insensible to these objects in consequence of being engrossed with its own operations any object of mental contemplation, which has either been called by the memory or created by the imagination, *will be seen as distinctly as if it had been formed from the vision of a real object.* In examining these mental impressions," he adds: "I have found that they follow the motions of the eye-ball exactly like the spectral impressions of luminous objects, and that they resemble them also in their apparent immobility when the eye-ball is displaced by an external force. If this result shall be found generally true by others, it will follow that the objects of mental contemplation *may be seen as distinctly as external objects,* and will occupy the same local position in the axis of vision as if they had been formed by the agency of light." This goes to the

very root of the theory of apparitions, all the phenomena of which seem to depend upon the relative intensities of the two classes of impressions, and upon the manner of their accidental combination. In perfect health the mind not only possesses a control over its powers, but the impressions of external objects alone occupy its attention, and the play of imagination is consequently checked, except in sleep, when its operations are relatively more feeble and faint. But in the unhealthy state of the mind, when its attention is partly withdrawn from the contemplation of external objects, the impressions of its own creation, or rather reproduction, will either overpower external objects, or combine themselves with the impressions of them, and thus generate illusions which in the one case appear alone, while in the other they are seen projected among those external objects to which the eye-ball is directed, in the manner explained by Dr. Brewster. To these physical causes of subjective apparitions, the forces of the imagination, of long desire, of strained attention, are supposed to contribute their influence.

It may be added that hallucinations, or whatever we are to call the impression of beholding objects of supernatural horror, are not confined to the human race. A remarkable example of superstitious horror shown by a dog, at the moment of a supposed apparition to his owner, is given in the *Edinburgh Medical and Surgical Journal*, vol. lxiv. pp. 186-187. In the same way, during the mysterious disturbances at the house of the Wesleys, "the mastiff was more afraid than any of the children." Popular superstition has used this belief. When the dogs howl in the Danish ballad, or in its Provencal counterpart, the cruel stepmother is afraid of the apparition of the dead mother, and treats the children kindly. In the same way, when Athene, in the *Odyssey*, appears to Odysseus, Telemachus cannot see her, but the dogs crouch and whine in fear. The case of Balaam's ass is sufficiently well known.

The latest and most important development of the belief in apparitions is that known as spiritualism. The believers in a religion based on pretended communications from the dead are numbered in America by millions. Their opponents say that their faith and practice help to fill the lunatic asylums, to which they easily reply that theirs is not the only creed that gives occasion to religious madness. Men of sense and experience are numbered in their ranks, and even in England it would be easy to name persons of eminence in art and literature, and some branches of science, who are puzzled by the phenomena they suppose themselves to have witnessed.

Modern spiritualism arose from one of the commonest superstitions in the world—the belief in haunted houses. What the Germans call the *Poltergeist* (the noisy spirit that raps and throws about furniture) is not peculiar to any country. We find it in Japan (see *Tales of Old Japan*), in Russia, in Egypt. Pliny tells of the haunted house of Athenodorus, the philosopher, in Athens. In Iceland the ghost of the dead thrall Glam raps on the roofs in the Gretti's saga; and "the Dyaks, Singhalese, and Siamese agree with the Esths as to such routing and rapping being caused by spirits." Such disturbances, accompanied with apparitions, haunted the house inhabited by Mrs. Ricketts, a sister of Earl St. Vincent. Scott says in reference to this case that "no one has seen an authentic account of the earl; " but his sister's report has recently been published. Every one has heard of the rappings in the house of the elder Wesley. Precisely the same phenomena occurred in the house of a Mr. Fox, in West New York, in 1847-48. It was discovered by his daughter, Miss Kate Fox, a child of nine years old, that the raps replied to hers. An alphabet was then brought, the raps spelled out words by knocking when certain let-

ters were pointed to, and modern spiritualism was born.

APPEAL, in its usual modern sense, is the act by which a decision is brought for review from an inferior to a superior court. In Roman jurisprudence it was used in this and other significations; it was sometimes equivalent to prosecution, or the calling up of an accused person before a tribunal where the accuser appealed to the protection of the magistrate against injustice or oppression. The derivation from the word *appello*, naturally shows its earliest meaning to have been an urgent outcry or prayer against injustice. Hence it is inferred a superior power capable of protecting against petty tyranny. In its meaning of seeking a higher tribunal for recourse against a lower, it does not seem to have been a characteristic of the Republic, where the magistrate was generally supreme within his sphere, and those who felt themselves outraged by injustice threw themselves on popular protection by *provocatio*, instead of looking to redress from a higher official authority. The Empire, however, introduced grades of jurisdiction, and the ultimate remedy was an appeal to the Emperor; thus Paul, when brought before Festus, appealed unto Cæsar. It must be understood that the appeal was actually dealt with by a supreme judge representing the emperor, not by the emperor in person.

When the progress of civilisation and the art of self-government render judges no longer amenable to the charge of tyranny or fraud, an appellate system changes its character and objects. It in some measure certainly tends to preserve that judicial integrity which renders it unnecessary as the immediate refuge of the persecuted suitor. But its ostensible object is the preservation of uniformity in the law. The attainment of this object renders it unfortunately necessary, in such a country as ours, that no tribunal shall give, in the first instance, in any important question, a decision which is not open to appeal. The process has the double advantage, that it has a tendency to bring every legal difficulty ultimately to one tribunal, where a uniformity of principle may be expected in the application of the law, and, at the same time, stimulates the exertions of the subordinate judge, who knowing that his proceedings will be revised, is careful to bring them as close as he can to those uniform principles of law, which he knows that the court of appeal will apply. To accomplish this function of an appellate system, it is right that the investigation of the question at issue should have been exhausted in the inferior court, and that the court of appeal should have nothing before it which has not been there considered; for if the inferior court decide on one representation of circumstances, and the court of appeal on another, the public will lose the advantage of having the principle which was applied in the inferior reversed or affirmed in the superior tribunal.

The United States, in adopting the structure of the English law, brought with it the practice of appeal and writ of error, but the federal constitution and the jealousy of central power have practically restricted the operation of the system. By the constitution the Supreme Court of the United States is vested with "appellate jurisdiction, both as to law and fact, with such exceptions, and under such regulations, as Congress should make." It appears to have been held, however, that this does not confer appellate jurisdiction, but only authorises Congress to create it. In the words of Mr. Kent, "If Congress had not provided any rule to regulate the proceedings in appeal, the court could not exercise an appellate jurisdiction: and, if a rule be provided, the Court could not depart from it. In pursuance of this principle, the Court decided in *Clarke v.*

Basadone, that a writ of error did not lie to that court from a court of the United States territory northwest of the Ohio, because the act had not authorised an appeal or writ of error from such a court."—(*Commentaries*, i. 324.) It was urged that the constitution itself had vested appellate jurisdiction in the Supreme Court, but that Congress may introduce such exceptions as it thinks proper. The action of Congress, it was said, is not required to create the jurisdiction, but is sufficient at any time to remove any part of it. The Court, however, has adhered to the view that its appellate jurisdiction is limited by the judiciary statutes, which are to be understood as making exceptions, and implying a negative on the exercise of such power in every case but those in which it is affirmatively given.

APPENDINI, FRANCESCO MARIA, historian and philologist, was born at Poirino, near Turin, on the 4th Nov. 1768, and died in 1837.

APPENZELL (for derivation see below), one of the twenty-five cantons of the Swiss Confederation, is an Alpine region, with an area of about 162 square miles, entirely surrounded by the canton of St. Gall. The climate is cold and variable, but not unhealthy. Subject like the rest of Switzerland to the Franks in the 8th century, Appenzell gradually passed into the hands of the abbots of St. Gall; in 1401 it rebelled against what had become an ecclesiastical tyranny; and in 1513 it was admitted into the Swiss Confederation. The violent struggles which followed the Reformation led to its division, in 1597, into two parts—the Inner Rhodes, in the south, being appropriated to the Roman Catholics, and the Outer Rhodes, in the north, to the Protestants. This distinction has continued to the present day; the census of 1870 giving the number of Protestants in the Catholic district as only 188, and of the Catholics in the Protestant, 2358. Until 1848, indeed, no Protestants, or even Catholic aliens, were allowed to settle in Inner Rhodes. The chief town of that division is Appenzell, and of the other, Trogen. Each district has its own democratic constitution, consisting of a General Assembly, where every freeman above 18 years is bound to appear, and a Great Council, chosen by the people, the members of which must submit their acts to the general approval for their ratification. Outer Rhodes sends two members to the *Nationalrath*, or House of Representatives of the Confederation, and Inner Rhodes one, besides the two members which the canton sends to the *Ständerath*, or Senate. Pop. of both cantons (1901), 68,780.

APPENZELL, the chief town of Inner Rhodes, in the canton of Appenzell, derives its name (*Abbatiss Cella Abtenzelle*), like Bischofszell and St. Peterzell in the same region, from its ancient ecclesiastical connection. It is situated in the beautiful valley of the Sitter, and has a church with an old Gothic choir, two convents, and a council-house. The *Landesgemeinde* holds its meetings in the open square. In the *Archiv* are preserved a number of ancient banners, and among them one captured from the Tyrolese, with the grotesque inscription, *Hundert Tausend Teufel*. The inhabitants, who are almost entirely Roman Catholics, are largely employed in the production of embroidery, and number about 3700.

APPERLEY, CHARLES JAMES, a sportsman and sporting writer, better known as "Nimrod," the *nom de plume* under which he publishes his works on the chase and the turf, was born at Plasgronow, near Wrexham, in Denbighshire, in 1777. About 1821 he began to contribute to the *Sporting Magazine*, under the pseudonym of "Nimrod," a series of articles, which from their racy character did the magazine admirable service. Its circulation doubled within two

years; and the proprietor, Mr. Pittman, with great liberality, kept for "Nimrod" a stud of hunters, and defrayed all expenses of his tours, besides giving him a handsome salary. The death of Mr. Pittman, however, led to a law-suit with the proprietors of the magazine for money advanced to "Nimrod," and the latter, to avoid imprisonment, had to take up his residence near Calais (1830), where he supported himself by his writings. He died in London, May 19, 1843.

APPETITE (Latin, *appetitus* from *appeto*, "I desire") is generally used of the natural desire for food experienced in health. Its causes are two: a condition of the stomach, not yet accurately understood, relieved by taking food and (2) a condition of the system not relieved until the products of digestion begin to be absorbed into the blood. The stomach-condition tends to recur at regular meal hours but may pass off if eating be long deferred.

APPIA VIA, the most celebrated of the ancient Roman roads, connecting the capital with Brundisium. It was commenced by Appius Claudius Cæcus (312 B. C.), who carried it from the Porta Capena to Capua. Its extension to Beneventum, and ultimately to Brundisium, making its total length about 350 miles, was completed before 30 B. C. The pavement, which rested upon several prepared substrata, was formed by large blocks of hard stone fitted to each other with great exactness. Its breadth was from 14 to 18 feet, excluding the foot-paths. From a statement in Procopius, it appears that the road was in perfect repair in his time (500-565).

APPIAN, an eminent writer of Roman history in Greek under the reigns of Trajan and Adrian. He was a native of Alexandria in Egypt, whence he went to Rome, where he became a distinguished advocate, and was chosen one of the procurators of the empire.

APPIANI, ANDREA, the best fresco painter of his age, born in Milan in 1754, died in 1817. He was made pensioned artist to the kingdom of Italy by Napoleon; but having lost his allowance after the events of 1814, he fell into poverty. He is also said to have painted Napoleon and the chief personages of his court. Among the most graceful of his oil paintings are his "Venus and Love," and "Orlando in the garden of Armida."

APPIUS CLAUDIUS. See **CLAUDIUS**.

APPLE. The apple is the fruit of *Pyrus Malus*, belonging to the Sub-order *Pomacea*, of the Natural Order *Rosacea*. It is one of the most widely cultivated, and best known and appreciated fruits belonging to temperate climates. In its wild state it is known as the crab-apple, and is found generally distributed throughout Europe and Western Asia, growing in as high a latitude as Dronheim in Norway. The crabs of Siberia belong to a different species, and are named *Pyrus baccata* and *P. prunifolia*. The apple-tree as cultivated is a modern sized tree with spreading branches, ovate, acutely serrated or crenated leaves, and flowers in corymbs. The fruit is too well known to need any description of its external characteristics. The apple is successfully cultivated in higher latitudes than any other fruit tree, growing up to 65° N., but notwithstanding this, its blossoms are more susceptible of injury from frost than the flowers of the peach or apricot. It comes into flower much later than these trees, and so avoids the night frost which would be fatal to its fruit bearing. The apples which are grown in northern regions are, however, small, hard, and crabbed, the best fruit being produced in hot summer climates, such as Canada and the United States. Besides in Europe and America, the fruit is now cultivated at the Cape of Good

Hope, in Northern India and China, and in Australia and New Zealand.

The most esteemed of all apples is the American Newtown Pippin, a globular, juicy, sweet and highly aromatic fruit; other American varieties of note are William's Favorite, Astrakhan and Gravenstein, and for winter use the Baldwin, Spitzenberg and Roxbury Russet.

Many exotic fruits have nothing in common with the apple, are known by that name, e. g., the Balsam apple, *Momordica balsamina*; the Custard apple, *Anona reticulata*; the Egg apple, *Solanum esculentum*; the Rose apple, various species of *Eugenia*; the Pine apple, *Ananassa*; *sativa* the Star apple, *Chrysophyllum Cainito*; and the apples of Sodom, *Solanum sodomium*.

APPLEBY, a market and borough town of England, capital of Westmoreland, situated on the Eden, 13 miles S.E. of Penrith. Population about 3,000.

APPLETON, a thriving town of Outagamie county, Wisconsin, is situated on the Fox river (which furnishes an abundant and valuable water power); also on the Chicago and North-Western; Milwaukee, Lake Shore and Western; and the Milwaukee and Northern railways, 119 miles from Milwaukee. The Fox river is navigable for steamers. The manufactures are numerous and important—boots and shoes, paper and pulp, furniture, agricultural implements, machinery, hardware novelties, lumber, woollens, crash, cordage, twine, hubs, spokes, etc. The city contains two national banks, one daily and four weekly papers, nine churches, graded schools, Lawrence University (founded by the Methodists in 1849), an opera house, several public halls, six hotels, and many stores. The city and country tributary are rapidly growing. Population (1900), 15,085.

APPOMATTOX COURTHOUSE, the county seat of Appomattox county, Va., worthy of note as the scene of the surrender of the confederate army, April 13, 1865.

APPRaiser, one who sets a value on property, real or personal.

APPRENTICESHIP—APPRENTICESHIP. Apprenticeship (from *apprendre*, to learn) is a contract whereby one person, called the master, binds himself to teach, and another, called the apprentice, undertakes to learn, some trade or profession, and to serve his master for a certain time. The contract is generally created by indenture, but any writing properly expressed and attested will suffice.

So far as can be seen it arose in the Middle Ages, and formed an integral part of the system of guilds and corporations by which skilled laborers of all kinds sought protection against the feudal lords, and the maintenance of those exclusive privileges with which in the interests of the public they were favored. In those times it was believed that the arts and sciences would not flourish unless such only were allowed to practice them as had given proofs of reasonable proficiency and were formed into bodies corporate, with certain powers of self-government and the exclusive monopoly of their respective arts within certain localities.

It has sometimes been supposed that these mediæval corporations were confined to such occupations as are now followed by artisans. This, however, is a mistake. The word *universitas* is the correct Latin name for any corporation whatsoever; and in mediæval parlance it was just as proper to speak of the university of smiths or tailors, as of the university of Paris or Oxford.

Dr. Adam Smith and most of his school strongly disapproved of apprenticeship, but only as it would seem when applied to trade and manufactures. They urged that the institution interfered with the property which every man has or ought to have in his own labor, and interfered not only with the liberty of the workman

but with that of such as might choose to employ him, and who were the best judges of his qualification. They further argued, that such laws tended to restrain competition to a much smaller number than would otherwise enter a trade; that a long apprenticeship, or indeed any at all, was unnecessary even for the nicest mechanical arts; that a few weeks or even days were sufficient to enable a man to set to work in such trades as clock and watch making; and that, if the workman was from the outset paid the full price of his work, under deduction of such materials as he might spoil from carelessness or inexperience, he would learn his art more effectually, and be more apt to acquire habits of attention and industry, than by working under a master who had a right to share in the produce of his labor. That there is considerable truth in much of this reasoning is undeniable. But taking all this in its worst view will hardly justify the sweeping charges brought against the institution of apprenticeship. The abolition of the laws which rendered apprenticeship compulsory has not, as Dr. Smith and his followers thought, led to its disuse. On the contrary, it or its equivalents have been voluntarily submitted to by such men as desired to exercise a trade to profit; for the public were not long in discovering that the regularly trained artisan was the only one whose work could be relied on. It is also worthy of notice that the rise of trades' unions has been coincident with the fall of the old trade corporations — thus indicating that artisans feel the necessity for some more powerful and orderly protection than the mere operation of the blind principle of supply and demand. For these and similar reasons, it is believed that few practical men will in the present day deny the advantages of apprenticeship. No one would probably advocate the restoration of the old guilds with their exclusive privileges; but many would perhaps incline to advise the institution of some order or degree by which, in certain trades, the workman who has passed through a regular apprenticeship may be distinguished from the man who is not so qualified.

APRICOT, the fruit of *Prunus armeniaca* (Linn.) *Armeniaca vulgaris*, according to others. Under the one name it is a species of the genus to which the plums belong, the other establishes it as a distinct genus of the natural order *Rosaceæ*. The apricot is, like the plum, a stone fruit, cultivated generally throughout temperate regions, and used chiefly in the form of preserves and in tarts. The French liqueur *Eau de Noyaux* is prepared from bitter apricot kernels.

APRIES (*Απριης*), the name by which Herodotus and Diodorus designate Pharaoh-Hophras, the eighth king of the twenty-sixth Egyptian dynasty.

APRIL was, in the old Roman reckoning, the second month of the year, but is counted in the Julian calendar as the fourth. In many countries of Europe, as England, France, and Germany, the first of April has for long been appropriated to a facetious custom, for which no very satisfactory origin has been assigned. To send an unsuspecting or ignorant person on some bootless errand is the great endeavor of the day. In Scotland the unfortunate subject of the trick is called a *gowk* — which has now, though the words were probably at one time different, the meaning both of “fool” and “cuckoo,” — and the mischievous errand-sending is “hunting a gowk.” In France the dupe is called *poisson d’Avril*, or April-fish. One remarkable theory traces the custom to Noah, as sending out his dove on such a quest; it is also referred either to the miracle plays representing the sending of our Saviour from Annas to Caiaphas and from Pilate to Herod, or to the change, in France, in 1564, of New Year’s day to the first of January, which left the first of April destitute of

anything but a burlesque of its former festivities; and more recently an identification has been attempted with the Hindoo festival of Huli, which is celebrated in a similar manner on the 31st of March.

A PRIORI and **A POSTERIORI**. The philosophical distinction expressed by these terms is to be explained by referring to the phraseology of Aristotle. According to him there may be a double starting-point in knowledge. When our individual progress in learning is chiefly considered, the things with which we are first and best acquainted may be termed earlier and *prior*; whereas the truths of a more general, primary, and fundamental character, to which we are subsequently led, have a later and *posterior* position. But if we lose sight of our personal interest in knowledge, then the priority may be more justly claimed by whatever is the cause or principle from which something else springs. In this sense the causal, original, and primary in the objective world is by nature *prior*; whilst the secondary and derivative existence is *posterior*. Priority in the first acceptation is only relative to us, and for general purposes may be called accidental; in the second acceptation, the priority is absolute, and without qualification. It is the second acceptation which Aristotle laid down as the properly philosophical one, and which regulates the usage of the phrases *a priori* and *a posteriori* by the schoolmen. In that sense of the term there can evidently be no *a priori* demonstration of first and fundamental principles. According to Aquinas, for example, there can be no *a priori* knowledge of God: because He, as uncaused and uncreated, cannot be deduced from anything prior in causation to Himself, and can only be apprehended rationally by means of that which is consequent upon His action, viz., the creatures of the natural world. In other words, our knowledge of Him must be *a posteriori*. It is obvious that science in the highest sense must be *a priori*, the knowledge must spring from an insight into causes, which are the true primaries. By an extension of this usage an argument is said to follow an *a priori* path, when from the basis of some conception it proceeds to evolve by analysis all or some of the logical consequences; whereas, the mode of reasoning, which endeavors to gather into a single formula the various facts of observation, is described as *a posteriori*. The argument of Anselm, which, from the mere conception of God, proposes to deduce his existence, is an example of *a priori* reasoning. An *a priori* reasoner has to predict what is or will be, by considering what ought to be in accordance with certain presuppositions. He tries by argument to assign beforehand the place of a fact which may not yet have been discovered by observation. From the analysis of certain given conditions, or by constructing the total product from some given elements, he seeks to anticipate experience. Of course, if the original conception be bad or defective, the conclusions will be false or inadequate. Often too, what claims to be the mere deduction from a conception, is secretly and perhaps unconsciously supplemented by more efficient elements of proof. It is this circumstance, that imperfect knowledge is taken as the ground for further conclusions, which has brought *a priori* reasoning into discredit.

APSE, the semicircular or polygonal termination to a church. These forms were no doubt derived from the *concha* or *bema*, in the classic and early Christian basilica.

APSHERON, a peninsula of Asia, in Georgia, extending from the eastern extremity of the Caucasus range for about 40 miles into the Caspian Sea, and terminating in Cape Apsheron. It produces naphtha, salt and saffron in great abundance; and has long been celebrated among the fire-worshippers of Asia for the sacred

fires that issue from its soil. On its southern coast is the port of Baku.

APT, the Roman *Apta Julia*, a town of France, in the department of Vaucluse, situated on the left bank of the Calavon, a tributary of the Durance, 30 miles east of Avignon. It is surrounded by ancient and massive walls, and is well built, although several of its streets are narrow and irregular. There are many Roman remains in and near the town, including a fine bridge, which is said to have been constructed by Julius Cæsar.

APULEIUS, LUCIUS, celebrated as a philosopher and a writer of romance, was born at Madaura in Numidia, about 125 A.D. As the son of one of the principal inhabitants, he received an excellent education, first at Carthage and subsequently at Athens. After leaving Athens he undertook a long course of travel, principally with the view of obtaining initiation into religious mysteries. On a journey to Alexandria he fell sick at (Ea (Tripoli), and was received into the house of Sicinius Pontianus, a former fellow-student. The widowed mother of Pontianus, Pudentilla, became enamored of the handsome young philosopher, who, at her son's request, as he affirms, consented to marry her. The lady's wealth rendered this step distasteful to the other members of her family, by whom, after the premature death of Pontianus, Apuleius was indicted on a charge of having gained her affections by magical arts. He easily established his innocence, and his spirited, highly entertaining, but inordinately long defence, is our principal authority for his biography.

There is little of Apuleius's own invention in the work on which his fame principally rests. The *Metamorphoses* or *Golden Ass* (which latter title seems not to be the author's own, but to have been bestowed in compliment), was founded on a narrative in the *Metamorphoses* of Lucius of Patrae, a work extant in the time of Photius. From Photius's account, this book would seem to have consisted of a collection of marvellous stories, related in an inartistic fashion, and in perfect good faith. The literary capabilities of this particular narrative attracted the attention of Apuleius's contemporary, Lucian, who proceeded to work it up in his own manner, adhering very closely to the original, but giving it a comic and satiric turn. Apuleius followed this rifaccimento, making, it, however, the groundwork of an elaborate romance, interspersed with numerous episodes, of which the beautiful story of Cupid and Psyche is the most celebrated, and altering the denouement to suit the religious revival of which he was an apostle. The most famous and poetically beautiful portion is the episode of Cupid and Psyche, adapted from a popular legend of which traces are found in most fairy mythologies, which explains the seeming incongruity of its being placed in the mouth of an old hag. The allegorical purport he has infused into it is his own, and entirely in the spirit of the Platonic philosophy. Don Quixote's adventure with the wineskins, and Gil Blas's captivity among the robbers, are palpably borrowed from Apuleius; and several of his humorous episodes, probably current as popular stories long before his time, reappear in Boccaccio.

APULIA, the name applied to a district of southern Italy, the limits of which were not very definitely or permanently marked. It is usually regarded as having been bounded by the country of the Frentani on the N., Samnium on the W., Calabria and Lucania on the S., and the Adriatic on the E. The northern portion comprised the district sloping eastward from the Apennines, but did not take in any part of the mountains themselves; while the southern portion was occupied by a rocky off-shoot of the main chain, which left only a narrow but fertile strip of land along the sea. On the

northern part of the coast was the remarkable mountain-mass of Garganus, forming an enormous promontory. Apulia was watered by the Tifernus (*Biferno*), the Frento (*Fortore*), the Cerbalus (*Cervaro*), the Aufidus (*Ofanto*), and a number of intermittent mountain streams. Reduced under Roman dominion in the 4th century B.C., Apulia for the most part continued true to the Roman cause till the time of the second Punic war, when it was greatly distracted and suffered grievously from the hostile operations of both the belligerents. It belonged to the second region of Augustus, and from the reign of Constantine was governed along with Calabria by a "Corrector." For several centuries after 476 it was alternately under the power of the Lombards, the Goths, the Saracens, and the emperors of the East; and about the 10th century was regularly governed by the last by means of a "catapan" or deputy, who has left the designation of his office, *Catapannata*, in the modern corruption *Capitanata*, applied to the northern portion of the present Apulia. It was conquered by the Normans under William Bras-de-Fer, who took the title of *Comes Apulie* in 1042, was raised along with Calabria to a dukedom by Robert Guiscard in 1057, and in 1127 was united to the Sicilian monarchy. The name Apulia is still employed as a geographical, but no longer as an ethnological designation. Pop. (1901), 1,949,423.

APURE, a river of Venezuela, formed by the confluence of the Orivante and the Sarare in and adjoining the Orinoco, after a course of about 500 miles. Its chief tributaries are the Caparo and the Portuguesa.

APURIMAC, or TAMBO, a Peruvian river which rises in the lagoon of Villafra, near Caylloma, flows in a generally northward direction, and, receiving the waters of the Velille, the San Tomas, the Mamara, the Pachachaca, the Pampas, the Mantaro, and the Perene, falls into the Ucayali, an affluent of the Amazon. The river formed by the Tambo—or Catonga, as it is called in this part of its course—and the Mantaro receives the name of Ene, and is joined by the Perene, a river large enough for the passage of steamers. About 30 miles further down it forms a great cataract, which breaks the navigation. After receiving the Muyupu and the Vilcamayu or Urubamba, the stream, under the name of Ucayali, flows north to join the other head-streams of the Amazon near Nauta. The navigation of the Apurimac below the falls is greatly hindered by its strong and rapid current. The whole length of its course is about 600 miles.

AQUAMBO or AKUAMU, a country in the interior of the Gold Coast of Africa, extending along both banks of the Rio Volta or Aswada. The portion to the west of the river is under British protection; and that on the east, with the exception of a narrow strip along the bank, is subject to the king of Dahomey.

AQUAPIM, a country of considerable extent in the interior of the Gold Coast of Africa, immediately behind Accra. It is watered by the Densu, Dinskoï, or Secoom, and is finely diversified with cultivated valleys and wooded hills of considerable elevation. The most important place is Akropong.

AQUARIANS, a name given to various sects of Christians in the primitive church who substituted water for wine in the communion service. This they did on principles of abstinence and temperance, or because they thought it unlawful under any circumstances to eat flesh or drink wine. Entirely distinct from those Aquarians upon principle, were others who used water at morning communion in order that they might not be discovered by the smell of wine.

AQUARIUM. This word is used to denote a vessel, or collection of vessels, in which marine or fresh water

animals may be kept, and in which marine or sweet water plants may be grown. The invention or rather growth of the modern aquarium cannot, in the absence of precise data, be accurately traced. The aquarium, as we find it at Hamburg or Brighton, has, like many other things now in daily use, been elaborated from small beginnings. It is known that more than two centuries ago marine animals were, for the purpose of study and observation, removed from the sea and kept in confinement; and there is extant a drawing, of the date of 1742, which represents the form of an aquarium containing zoophytes. About the year 1839 a movement was made towards the construction of aquariums of a more elaborate description, which lasted for more than twenty years, during which time a large number were made, and many descriptive works published on the subject. Agencies were during that period established in London and elsewhere for the supply of animals; and some at the same time made it a business to purvey sea-water—the obtaining of this, and keeping it fresh, being with many persons who lived far from the sea a great difficulty. Indeed the difficulty was so great that an artificial compound was in numerous instances resorted to for lack of genuine sea-water. A solution of this difficulty came tardily, in 1841. Mr. Ward at that time constructed in London a fresh-water aquarium, in which aquatic plants were very successfully grown for the purpose of keeping the water pure and the animals healthy; and a year later, Dr. George Johnston of Berwick-on-Tweed, accidentally discovered, in the course of making an experiment for another purpose, that the animal and plant life of the sea could also be made to support each other. For a period of sixty days he kept some animals in a jar without once changing the water, and thus solved the problem. Early in 1847 Mrs. Thynne of London successfully investigated the problem, whether it was possible to keep the animals in good condition of health without changing the water. In 1849 Mr. R. Warington, also of London, and afterwards Mr. P. H. Gosse, conducted successful experiments having for their object the balancing of vegetable and animal life, which afterwards came to be thoroughly recognised. Sea-weeds, however, do not bear transplanting, but sea-water is so impregnated with the seeds or germs of vegetable life, that when a few stones or fragments of rock are taken from the ocean, marine vegetation speedily commences and proceeds. In 1853 a fish-house or aquarium of considerable size was constructed by the Zoological Society of London in their garden in the Regent's Park. This erection gave such an impetus to the popular aquarium movement as rendered it almost a mania, and for a year or two these scientific toys, some of them of large size, became much appreciated household ornaments.

It does not answer very well, even when an aquarium is at the sea-side, to be constantly changing the water, as the new supply is so disturbed and impregnated with impurities as to be fatal to delicate animals, besides not being in a proper state for exhibition. Some of the inhabitants of an aquarium foul the water very much more than others, notably the flat fish family, and provision has to be made for this by putting such other animals in the same tank as will aid in purifying the water. Various small animals have of course to be provided as food for the larger marine specimens; others of them act as scavengers, helping to keep the water constantly sweet and clean. The light admitted to fish in the tanks is also a matter of careful adjustment. As the animal life and vegetable life mutually support each other, the kind of material necessary for maintaining the "compensating system" must be watchfully supplied. Mr. W. R. Hughes of Birmingham recommends the growth of sea-lettuce (*Ulva latiss-*

ima) in tanks, as suitable both for oxygenating the water and for food for the fishes; the stock plants being introduced in the autumn months, when they are loaded with spores. Now that such excellent aquariums as those at Brighton, Manchester, Southport, and Sydenham are in full working order, the construction of others will not be difficult, even when projected on a larger scale. Distance from the sea is of no consequence, as sea-water may be obtained by railway, and can be kept stored as already suggested.

AQUEDUCT, a conduit or channel for the conveyance of water, but commonly a structure of masonry erected to conduct water across a valley at a high level, though structures of this kind would be more properly termed aqueduct bridges. This distinction it is necessary to bear in mind, more particularly when dealing with the undertakings of this class carried out by the Greeks and Romans respectively, because from the fact of the former having apparently seldom if ever constructed aqueduct bridges, it has been usual to institute a very unfavorable comparison between them and the Romans, who, with imperial disdain of obstacles, furnished the cities of their immense empire with a series of constructions of this kind for the supply of water, which still in their ruins excite our astonishment. True to the difference in national genius the Greeks, following the analogy of nature, in which in their own country they saw the water collected in the hills passing for miles along subterranean courses, and issuing in cool fountains at the coast, adapted their system of conduits to the physical formation of a district, cutting tunnels and canals, rather than bridging over valleys, and as a consequence no conspicuous monument of their system now remains. But even if what they did was so little as to justify Strabo in charging them with neglect in this matter as compared with the carefulness of the Romans, it is still clear from the records that they accomplished much, and that in this, as in other respects, they were the instructors of the Romans. It is here to be premised that the term aqueduct applies only to the conveyance of such water as was used for drinking or other useful purposes, and not to the draining of marshes, though in both cases the works may often have been of the same kind. The insufficiency of water, supplied by natural springs and cisterns hewn in the rock, which in an early age had satisfied the small communities of Greece, had become a pressing public question by the time of the Tyrants, of whom Polycrates of Samus and Pisistratus of Athens distinguished their rule by extensive works to meet the exigencies of their states. For this purpose the former obtained the services of Eupalinus, an engineer celebrated for the skill with which he had carried out the works for the water supply of Megara, under the direction of the Tyrant Theagenes (circa 625 B.C.) At Samus the difficulty lay in a hill which rose between the town and the water source. Through this hill Eupalinus cut a tunnel 8 feet broad, 8 feet high, and 4200 feet long, building within the tunnel a channel 3 feet broad and 11 ells deep. The water, flowing by an accurately reckoned declivity, and all along open to the fresh air, was received at the lower end by a conduit of masonry, and so led into the town, where it supplied fountains, pipes, baths, cloacæ, &c., and ultimately passed into the harbor. In Athens, under the rule of Pisistratus (B.C. 560), a similarly extensive, if less difficult, series of works was completed to bring water from the hills Hymettus, Pentelicus, and Parnes. From Hymettus were two conduits passing under the bed of the Ilissus, and most part of the course cut in the rock. Pentelicus, richer in water, supplied another conduit, which can still be traced from the modern village of Chalandri by the air shafts built several feet

above the ground, and at a distance apart of 40-50 metres; the diameter of these shafts is 4-5 feet, and the number of them still preserved is about sixty. Tributary channels conveyed into the main stream the waters of the district through which it passed. Outside Athens, those two conduits met in a large reservoir, from which the water was distributed by a ramification of underground channels throughout the city. These latter channels vary in form, being partly round, partly square, and generally walled with stone; the chief one, that under the bazaar, is sufficiently high and broad to allow two men to pass in it. Sometimes pipes of baked clay were laid within them. The conduit from Mount Parnes appears to have been reconstructed in later times. Some of these aqueducts continue to supply Athens to this day, and are described as marvels of enterprise and skill. In Sicily, the works by which Empedocles, it is said, brought the water into the town of Selinus, are no longer visible; but it is probable that, like those of Syracuse, they consisted chiefly of tunnels and pipes laid under ground. The system of conduits in Syracuse which Thucydides says (vi. 100) the Athenians partly destroyed on the Sicilian expedition, still supplies the town with an abundance of drinkable water; and at one point, where the tunnel passes under the sea to the island of Ortygia, presents what has long been regarded as a remarkable achievement for early times. An example of what appears to have been the earliest form of aqueduct in Greece has been discovered in the island of Cos, beside the fountain Burinna on Mount Oromedon. It consists of a bell-shaped chamber, built underground in the hill side, to receive the water of the spring and keep it cool; a shaft rising from the top of the chamber supplied fresh air. From this reservoir the water was led by a subterranean channel, 35 yards long and 2 yards high.

Of the constructions for the conveyance of water in Italy in early times, there is an example at Tusculum, consisting of an oblong basin, divided into several chambers, which received the water of a spring, and then distributed it by pipes (*tubi*, *fistulae*) or canals. The basin is built of blocks of stone, which, along the sides, overlap each other, till they meet and form a roof—a principle of building which was afterwards supplanted by vaulting, and which occurs also in the earliest Greek masonry. The pipes were either of lead or baked clay. When the course lay in soil, gullies were cut and conduits of masonry built within them. When rocky ground intervened, tunnels were pierced, and in both cases shafts were made at intervals of about 240 feet, to admit light and fresh air. The inside of the walls of these channels received a coating impervious to water, composed of chalk and crushed fragments of tile. Where the course was interrupted by an inequality in the ground, a vertical pipe (*venter*) was placed reaching to the surface or above it. The water rushing up this pipe was freshened by contact with the air, and again fell back to the new course which it had to take. Works of this kind, undertaken for the public convenience, were paid for out of the public purse, a tax being levied for the use of the water.

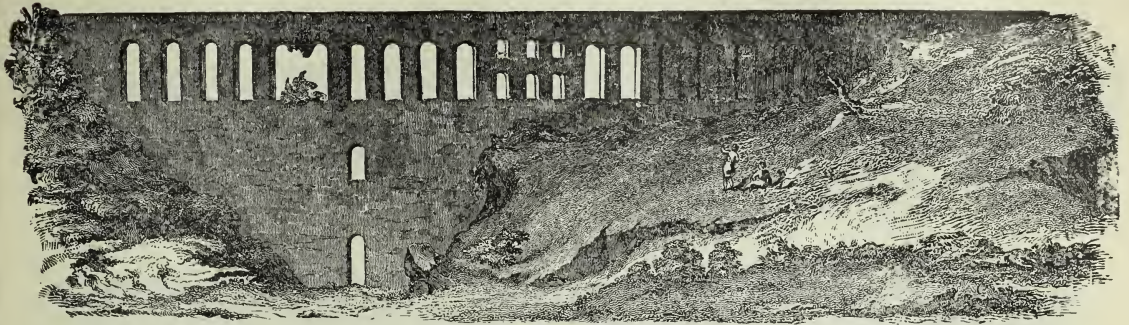
If, to obtain a proper decline, the water-course had to be carried above ground, the simple plan was to support it on a stone wall, and in this case the conduit itself was also built of blocks of stone, coated with a stucco impervious to water. But since a solid wall across a valley would have cut off the usual traffic, it was found necessary to break up the wall, by means of arches, into a series of pillars, and with this commenced the system of aqueduct bridges, which have proved to be the most striking monuments of the Roman empire. as perhaps the best known instance of this double pur-

pose, of an archway under which traffic might pass, and over which water might be conveyed, there is the Porta Maggiore at Rome. The waters conveyed over it in two separate channels, are the AQUA CLAUDIA and the ANIO NOVUS, and from the three inscriptions above the arches it appears (1.)—that the Emperor Claudius had constructed the so-called Aqua Claudia Aqueduct from the springs Cæruleus and Curtius, 45 miles from Rome; (2.) that the same emperor had constructed the so-called Anio Novus Aqueduct from the 62d milestone from Rome; (3.) that the Emperors Vespasian and Titus had restored these splendid undertakings of Claudius. Both aqueducts had been begun by Caligula, 38 A.D., and were completed ten years after by Claudius. The two springs from which the Aqua Claudia took its rise were in the Sabine hills near the 35th milestone, on the Via Sublacensis. It was augmented by part of the Aqua Martia, famous for the goodness of its water, and, owing to bends in the course, reached the length of 45 miles, as stated in the inscription, 35 miles of it being under and 10 above ground. The Anio Novus, so called to distinguish it from an older aqueduct, the Anio Vetus, took its rise in the river Anio at the 62d milestone, on the road just named, the water being first collected in a large basin, where it was allowed to purify itself. At the 32d milestone it was augmented by the clearer water of the spring, *rivus Herculaneus*. The entire length of 62 miles was partly above and partly below the ground. About 6 miles from Rome it approached the Aqua Claudia, and from that point the two waters travelled together to the city in two distinct channels, one above the other, and supported by a chain of arches, which at one place reached the height of 109 feet. But in height these arches must yield to those of the aqueduct at Nismes, the ancient Nemausus, erected in the time of Augustus, which rose to 180 feet. The Pont du Gard, as the aqueduct at Nismes is now called, consists of three rows of arches striding across the valley of the river Gardon. In the lowermost row are six arches, of which one has a span of 75 feet, the others each 60 feet. In the second row are twelve arches, each with a span of 75 feet. In the third row are thirty-six smaller arches, immediately above which was the water-course. As a bridge, the Pont du Gard has no rival for lightness and boldness of design among the existing remains of works of this class carried out in Roman times.

Besides the two principal aqueducts at Rome already described, there remain to be noticed twelve more which assisted in the supply of water for the city. These are (1.) AQUA APPIA, which took its rise at the foot of the Alban mountains on the Præneste road, between the 7th and 8th milestones, and measured from its source to the Porta Trigemina 11,180 paces, of which 11,130 were below ground. It appears to have been the first important enterprise of the kind at Rome, and was the work of the old Censor Appius Claudius, from whom it derived its name. The date of its construction was the year of Rome 442, according to Frontinus, an overseer of aqueducts under the empire, whose work *De Aqueduct. urb. Romæ* we still possess. (2.) ANIO VETUS, constructed forty years after the last-mentioned aqueduct, by the Censor Manlius Curius Dentatus, with the help of L. Papirius Censor, who finished it. From its source near Tivoli, on the left side of the Anio, it flowed 43,000 paces, of which 42,779 were below ground, and 221 above. At the distance of 2 miles from Rome (Frontinus), i. 21 it parted into two courses, one of which led to the *horti asiniani*, and was thence distributed; while the other led by the temple of Spes to the Esquiline gate, the site of which was near the modern Villa Negroni, where, in 1861, was found a subterra-

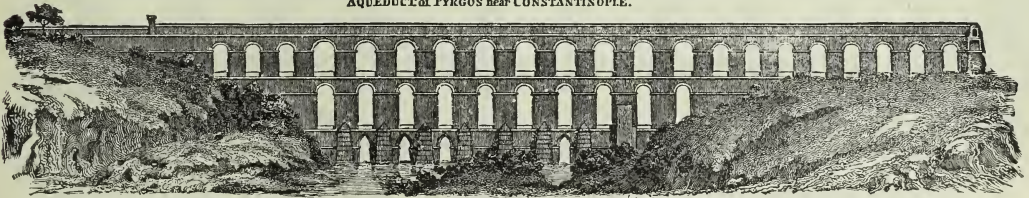
AQUEDUCT.

AQUEDUCT near ANTIOCH.



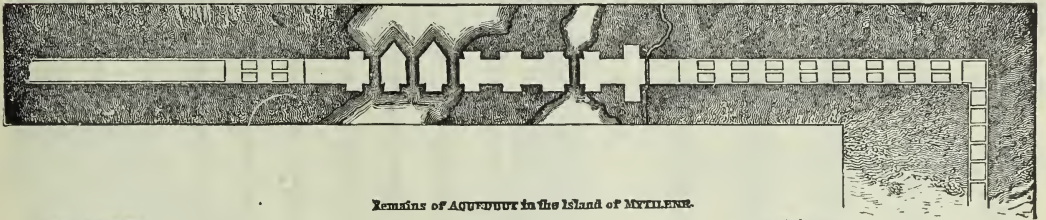
150 feet

AQUEDUCT of PYRGOS near CONSTANTINOPLE.



150 feet

Ground Plan.

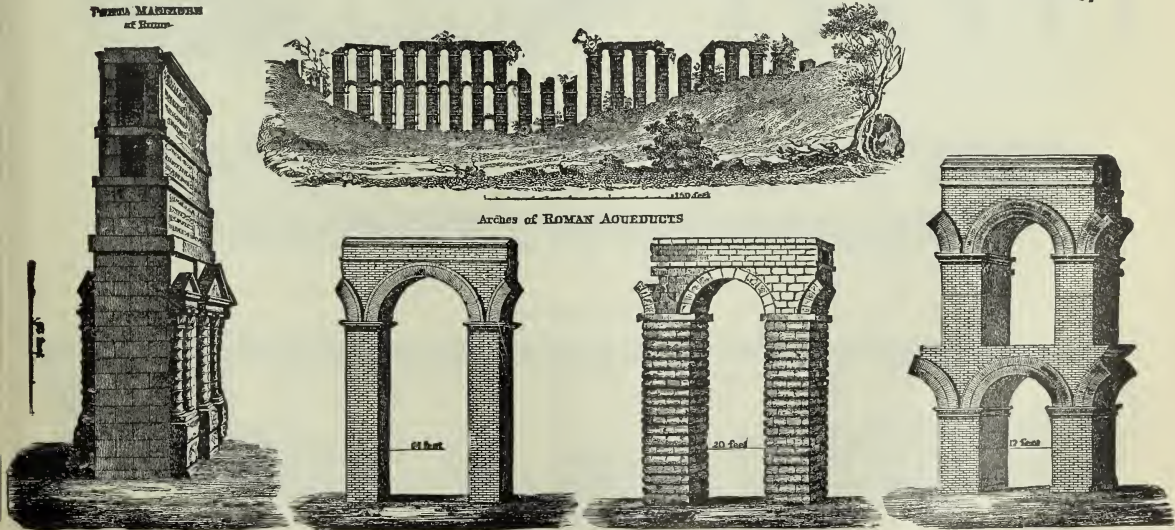


Remains of AQUEDUCT in the Island of MYTILENE.

THEATRA MARITIMA
at Mytilene



ARCHES of ROMAN AQUEDUCTS



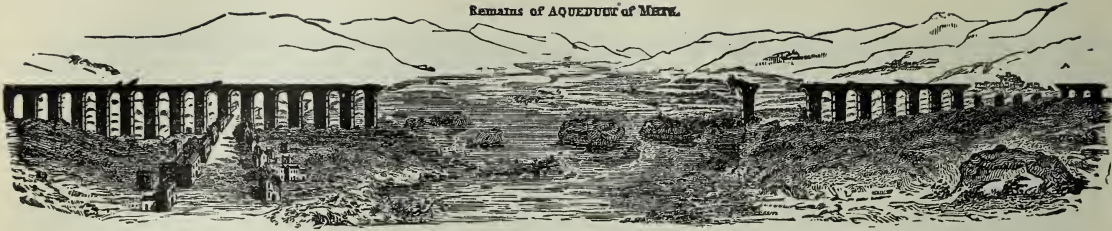
61 feet

40 feet

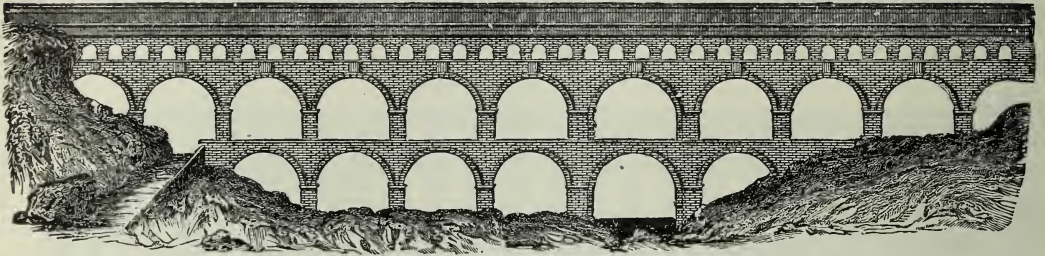
17 feet

AQUEDUCT.

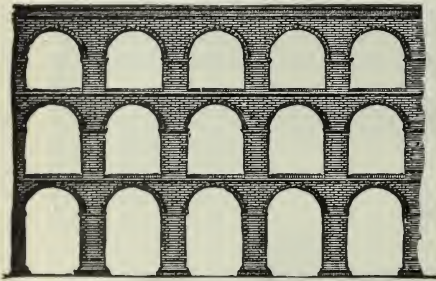
Remains of AQUEDUCT of METZ.



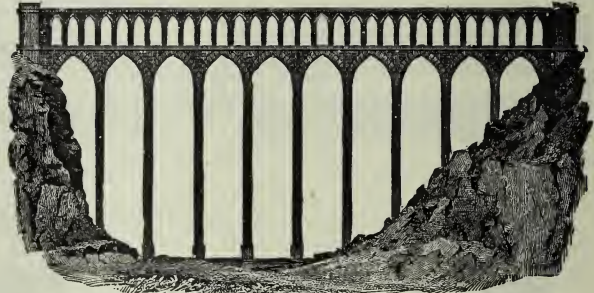
AQUEDUCT of FONT DU GARD near NISMES.



AQUEDUCT of MAINTENON.



AQUEDUCT DELLE TORRE, SPOLETO.



Scale 500 Feet

GREEK AQUEDUCT. (Enlèvement Canal)



DES AQUEDUCT. (Enlèvement Canal)



Scale to all the Figures excepting Spolia. 500 Feet

anean conduit and an inscribed stone, which left no doubt as to its having been one of the stones set up to mark the distances of the Anio Vetus. (3.) **AQUA MARTIA**, rising on the left side of the Via Valeria, traversed 61,710 paces, of which 54,247 were underground, and the remaining distance carried partly on solid wall and partly on arches. It was the work of Quintus Martius Rex, and took its name from its constructor. Its waters were celebrated for their coolness and excellent quality. (4.) **AQUA TEPULA**, from its source in the district of Tusculum, flowed 10,000 paces, mostly above ground, and on the same series of arches as carried the Aqua Martia, but at a higher level. It was the work of the Censors Cn. Servilius Cæpio and L. Crassus Longinus, and was completed in the year 126 B.C. Again, partly on the same structure of arches, and with a still higher channel, flowed—(5.) **AQUA JULIA**, from a source near that of the last-mentioned aqueduct to within 7000 paces of the walls of Rome, where the joint waters were received in a reservoir, and thence distributed in various channels to the city. Its entire length was 15,426 paces. It was constructed in the year 34 B.C. by Marcus Agrippa, to whose zeal to meet public wants in this direction were due the two other aqueducts—(6.) **AQUA VIRGO**, and (7.) **AQUA CRABRA** or **DAMNATA**, the former as well known for the goodness of its water as was the latter for the inferiority which procured it the designation of *Damnata*. The Aqua Virgo, from its origin at a copious spring in a marsh on the Collatine way, not far from the ancient Gabii, measured 14,105 paces, along which it was conveyed in pipes, partly under and partly above ground, on a solid substructure or on arches. It was completed in the year 48 B.C. (8.) **AQUA ALSIETINA** or **AUGUSTA** rose in Etruria, on the Via Claudia, and travelled 22,172 paces, of which 358 were on arches. It was the work of Augustus, whose object was to furnish by it water for gardens and other than drinking purposes. (9.) **AQUA TRAJANA**, rising in Lake Sabatinus (Bracciano), was constructed by Trajan. (10.) **AQUA ALEXANDRINA**, rising in the district of Tusculum, was the work of Alexander Severus. (11.) **AQUA SEPTIMIANA** seems to have been only a branch led from the Aqua Julia to supply the baths of the emperor from whom it takes its name, Septimius Severus. (12.) **AQUA ALGENTINA** rose on Mount Algidus; at whose instance it was made is unknown. Of the fourteen aqueducts which supplied ancient Rome, three remain in use at the present time, furnishing the modern city with abundance of water. The first of the three is the Aqua Virgo, now known as Fontana di Trevi, supplying the best water in Rome. It was restored by Pope Pius IV. The next is the Aqua Claudia, known as the Aqua Felice or di Termini, which was restored by Sixtus V. The third is the Aqua Trajana, called, from the Pope who restored it, viz., Paul V., Aqua Paole.

At regular intervals along the course of an aqueduct were built reservoirs (*castella*), to enable repairs to be made at any point, and also to let off water for the population of the district through which it passed. It was the law that material necessary for repairs should be supplied from the private property nearest to where the damage was, and should be conveyed at the cost of the owner of such property. *Castella* of smaller dimensions were also required in many parts of the city. Of these, it was said, there were 247 in Rome. To allow the water to purify itself before being distributed in the city, large basins were built outside the walls. For the process of purification salt was used. These piscinæ were covered in with a vaulted roof, and were usually on a colossal scale, as in the example still preserved at Fermo, which consists of two stories, each

having three oblong basins communicating with each other; or the Piscina Mirabile at Baïæ, which is covered in by a vaulted roof, supported on forty-eight pillars, and perforated to permit the escape of foul air. Two stairs lead by forty steps to the bottom of the reservoir. In the middle of the basin is a sinking to collect the deposit of the water. The walls and pillars are coated with a stucco so hard as to resist a tool. The oversight of aqueducts was placed, in the times of the republic, under the *ædiles* and censors, though the latter appear to have taken part in the work of this kind rather from their financial interest in the matter. Under the empire this task devolved on special officials.

The great waterworks that supply the city of Marseilles with the water of the Durance, by a canal about 60 miles in length, are among the boldest undertakings of the kind in modern times. This canal, begun in 1839, and completed in 1847, is conveyed through three chains of limestone mountains by forty-five tunnels, forming an aggregate length of $8\frac{1}{2}$ miles, and across numerous valleys by aqueducts; the largest of which, the Aqueduct of Roquefavour, over the ravine of the River Arc, about 5 miles from Aix, surpasses in size and altitude the ancient Pont du Gard. The immense volume of water, which passes at the rate of 198,000 gallons per minute, is carried across as in the old Roman aqueducts by a channel of masonry work. The height of this aqueduct is 262 feet, and its length 1287.

Within the last century, the invention and improvement of the manufacture of cast iron has completely changed the mode of conducting water into cities, by the introduction of cast-iron pipes instead of the stone conduits of former times. These pipes can now be of almost any dimensions, and united together into a continued series so closely as to prevent the escape of the water even under a violent pressure, arising from the altitude of the fountainhead. They enable us, therefore, to take advantage of and give effect to the fundamental principle of hydrostatics, that the fluid tends continually to a level, even though it be confined in the smallest or most complicated system of pipes; so that however low it be carried in any valley, or to whatever distance, still it will rise on the opposite side to the original altitude of the fountainhead—a principle which is most important indeed in such works, seeing that by it we are not restricted, as the Romans were, almost to a perfect level in the line of the conduit. We have seen that, for the purpose of attaining this level or very gentle declivity all along the conduit, they were under the necessity of raising it by arcades continued in one unbroken series, frequently 30 or 40 miles in extent; and, in addition to this, they had often to prolong the length of the track by a circuitous route, turning and winding for miles out of its course, for the very purpose of increasing its length.

But the use of pipes enables us to dispense with these long arcades all raised nearly to the same level with the fountainhead; because the conduit may be varied in its level to any extent, and still will rise at last to its original altitude. The pipes, therefore, are merely laid all along the surface of the ground, with a cover of 2 or 3 feet of soil to place them beyond the reach of frost. To prevent, however, the frequent or abrupt alternations of rise and fall, any sudden inequalities in the ground are equalised by cuttings and embankments, but not to anything like the extent that would be required to raise the whole to a level. This, therefore, forms a very great improvement in the method of conducting water, the greatest indeed which has ever been made in this important branch of practical mechanics. That it was not introduced by the Romans, is not to be ascribed, as many have supposed, to their ignorance of the hydro-

static principle that the fluid would rise to a level in the opposite branches of the same train of pipes. They were well acquainted with this principle, and a portion of a leaden pipe, supposed to have been used in the baths of Caracalla, has been found, which sets this matter at rest; but, from the low state of the arts at that period, they were unable to give effect to the principle. They had not the means of fabricating pipes of such a magnitude as would have been required for the enormous quantities of water consumed in Rome, and at the same time, of strength sufficient to withstand the pressure from the fountainhead. Lead was the only material that could be used by them for the purpose; and besides the enormous thickness that so weak a material would have required, and the impracticability of their forming pipes, and uniting them together endwise, they were too well acquainted with the tendency of lead to render the water unwholesome by its poisonous impregnation. The use of cast iron was quite unknown. There remained, therefore, no resource but in the aqueducts, which, though attended no doubt with vast expense, and requiring great enterprise, skill, and patience, were yet attainable by these means, and formed when completed a simple and very perfect mode of effecting the object. Now, however, when the manufacture of cast iron has been brought to such perfection, and methods contrived for uniting perfectly together all the pipes into one connected train, this improved system has been universally adopted.

Croton Aqueduct, New York.

The Croton Aqueduct, by which the city of New York is supplied with water, was justly regarded at the time of its execution, from 1837 to 1842, as one of the most magnificent works of the kind in modern times. Its length from the Croton Lake to the receiving reservoir is $38\frac{1}{4}$ miles. The original reservoir, called Croton Lake, is formed by an embankment across the Croton Creek, a small stream of wholesome water falling into the Hudson. It covered 400 acres, and contained about 500,000,000 gallons of water. To the valley of the Harlem River, a distance of 33 miles, the aqueduct is built of stone, brick, and cement, arched over and under, 6 feet 3 inches wide at the bottom, 7 feet 8 inches at the top, and 8 feet 5 inches high, and capable of discharging 60,000,000 gallons per day. It is carried over the Harlem Valley in iron pipes, laid upon a magnificent bridge 1460 feet long, constructed of arches 114 feet above high-water mark at Yorkville. These pipes passed into a receiving reservoir capable of holding 150,000,000 gallons, and from thence the water was conducted for $2\frac{1}{2}$ miles to a distributing reservoir, containing 20,000,000 gallons, by a double line of iron pipes, 3 feet in diameter. From this reservoir the water was distributed to the city.

The Croton water was originally introduced into New York in 1842, when the population was about 450,000 persons, and from that time to 1848, 18,000,000 gallons per day gave an abundant supply. In 1872, with a population of 1,000,000 persons, the quantity required was 88,000,000 gallons per day. Thus, between 1848 and 1872, while the population little more than doubled, the consumption of water increased nearly five times. This fact, coupled with severe droughts in 1870 and 1871, when the natural volume of the Croton River fell to 27,000,000 gallons per day, caused great anxiety, and shewed the necessity of largely extended works. It was estimated that the basin above the Croton Dam, 339 square miles in area, would give 300,000,000 gallons per day on the average, if the water could be impounded, and that, therefore, abundant water could be obtained by increasing the number or capacity of the impounding reservoirs. New reservoirs were therefore projected,

one of which, to contain 3,000,000,000 gallons, was completed in the autumn of 1872. With this the gross storage was increased to the amount of 4,670,000,000 gallons, in addition to the daily produce of the Croton river, which, at its minimum as stated, is 27,000,000 gallons per day. Another reservoir, the contents of which when full is said to be 3,700,000,000 gallons, was also projected, and is being constructed. To meet the growing demand for water, the reservoirs were not only increased as described, but the means of distribution were largely extended, and in one part of the city six lines of pipes four feet in diameter were laid side by side.

Loch Katrine Aqueduct, Glasgow.

The Loch Katrine Aqueduct of the Glasgow Waterworks is the modern aqueduct which has most probably attracted the largest share of public attention.

The appropriation of the beautiful waters of Loch Katrine — rendered classical by Sir Walter Scott — the romantic, rugged, and almost impassable Highland country through which the aqueduct had to be constructed, and the distance from Loch Katrine to Glasgow, all contributed to lend a special interest to the undertaking. It is, however, a very simple work in itself, for, with but little artificial addition, Loch Katrine, Loch Venachar, and Loch Drunkie were converted into impounding reservoirs, the first for the supply of the city, and the two latter for compensation.

Vienna Waterworks.

A still more recent work, consisting mainly of aqueduct construction, is the enterprise for supplying the city of Vienna with water. The water is obtained from the springs of Kaiserbrunn and Stixenstein, both situated at the foot of the Styrian Alps, which separate Austria from Styria. The Kaiserbrunn spring is situated 1146 English feet above the Danube at Vienna, and the Stixenstein spring 996 feet. The water is conducted by aqueduct to a receiving reservoir at Rosenhugel, 277 feet above the Danube, and distant 2 miles from Vienna. The length of the aqueduct from Kaiserbrunn to the receiving reservoir on the Rosenhugel, is $56\frac{1}{2}$ English miles. A branch of 3.9 English miles conducts the Stixenstein spring to this aqueduct. The gradients of the aqueduct vary much in the upper or early parts; but towards the end they become more regular. The gradients have been thus varied for the purpose of keeping the canal as much as possible along the level of the ground, so as to avoid high embankments. In order to keep the water cool in summer, and to secure it from freezing in winter, the water is always 6 feet below the surface; and in places where embankments were unavoidable, the aqueduct has been covered to the same extent. The size of the aqueduct varies from 4 feet 6 inches in height, by 2 feet 6 inches in width, to 6 feet 6 inches in height, by 4 feet in width. In order to facilitate the discharge, and to reduce friction, the inside of the aqueduct has been plastered with a coating 2 inches thick of Portland cement and sand, in proportion of one of cement to two of sand. This coating was laid on in three layers, the last being a very thin layer of pure cement, which, when hardened, was rubbed with iron plates till it became perfectly smooth and polished. The work was commenced in the winter of 1869–70, and completed in the month of September 1873. The aqueduct is constructed for the purpose of supplying about 3,200,000 cubic feet per day, 20,000,000 gallons. There are several important aqueduct bridges along the line of works. Of these the principal is the aqueduct of Baden, which consists of forty-three large arches, with spans varying from 5 klafters to $8\frac{1}{2}$ klafters, and the greatest height 15 klafters 5 feet 5 inches,

or 96.6 English feet, from the foundation of the pier to the top of the aqueduct. The arches are of brickwork, as well as the vaulting of the canal. The piers, together with the backing of arches and the sides of the canal, are faced with ashlar, and filled up with rubble masonry. The canal is covered on the top with earth, which is then covered with 9 inches of paving in rubble masonry.

AQUILA, a town of Italy, capital of the province of Abruzzo Ulteriore II., beautifully situated on the Aterno about 56 miles from Rome. It is a well-built place, containing a citadel, which dates from 1534, a cathedral (*S. Bernardino du Siena*), as well as numerous other churches and religious establishments, a theatre, a fine town-hall, and a number of ancient mansions, such as the *Palazzo Torres*, with its picture-gallery, and the *Palazzo del Governo*, the residence of Margaret of Austria. Its chief manufactures are paper, linen, and wax; and it has a large trade in saffron, the principal product of the surrounding district. Aquila was founded about the year 1240, by the emperor Frederick II. who peopled it with the inhabitants of the ancient *Amiternum*, the birthplace of Sallust, the ruins of which are still to be seen about 3 miles from the town. It soon became a very flourishing city; but war, pestilence, and especially earthquakes (1703, 1706), have done much to reduce its importance. Population, (1901), 21,215.

AQUILA, a native of Pontus, who flourished about 130 A.D., celebrated for his translation of the Hebrew Scriptures into Greek. This account, however, is more than doubtful. Aquila's version of the Scriptures was exceedingly close and accurate, and is said to have been used in place of the Septuagint in the synagogues. Though the Christians generally disliked it, alleging without due grounds that it rendered the Messianic passages incorrectly, Jerome and Origen speak in its praise.

AQUILA, KASPAR, the Latin name of Kaspar Adler, a celebrated German theologian who espoused the cause of the Reformation. He was born at Augsburg in 1488; and after studying there as well as at Berne and Leipsic, and for several years in Italy, he was appointed pastor of Jenga, a village near Augsburg. Here he embraced the doctrines of Luther; but his boldness and zeal in the cause of the reformed faith led the bishop of Augsburg to order his arrest. Aquila passed the winter of 1519-1520 in the prison of Dillingen, and was only liberated through the influence of Isabella of Denmark, sister of the emperor Charles V. From Dillingen he went to Wittenberg, where he became personally acquainted with Luther; and thence he went as tutor to the family of Franz von Sickingen, in the castle of Ebernburg. After a short stay at Eisenach, Aquila was appointed professor of Hebrew at Wittenberg, where he rendered valuable assistance to his colleague Luther in his translation of the Old Testament. In 1527 he became pastor, and the following year Protestant bishop at Saalfeld; but his vehement opposition to the *Interim* of Charles V. in 1548, obliged him to flee from the place, and accept the offer from the countess of Schwarzbürg of a temporary asylum in her castle of Rudolfsstadt. He was appointed to the deanery of Schmalkalden in 1550, and restored two years after to his office at Saalfeld, where, without further molestation, he continued to discharge his duties till his death, 12th November 1560.

AQUILA, SERAFINO DELL', a famous Italian poet and improvisatore, was born in 1466 at the town of Aquila, from which he took his name, and died in the year 1500. His principal patrons were the Borgias at Rome, from whom he received many favors.

AQUILEIA, an ancient city, at the head of the Adriatic, founded or at least colonised by the Romans

about 181 B.C., which, on account of its commanding the north-eastern entrance into Italy, soon rose into importance as a commercial centre and as a military post. Connected by the Æmilian way with the capital and the south, it was also the starting-place of the roads to Rhætia, Pannonia, Istria, and Dalmatia. The surrounding territory was highly fertile, and yielded abundance of wine; while gold was found in considerable quantities in the neighborhood. Aquileia was chosen by Julius Cæsar as headquarters for his forces in Cisalpine Gaul, and was frequently the *point d'appui* of imperial campaigns. It was strongly fortified by Marcus Aurelius in 160, and was able in 238 to frustrate the long-continued siege of Maximin. About this time it was one of the most important and flourishing cities of Italy. It was recognised as the capital of Venetia, and allowed to have the altogether exceptional privilege of a mint. It is now a small fishing village of 1956 inhabitants, containing a number of interesting remains of its ancient splendor, and often rewarding the researches of the antiquary with relics of value.

AQUILLIUS, MANIUS, was Roman consul in 101 B.C., and successfully reduced a revolt of slaves in Sicily. In 88 B.C. he acted as legate against Mithridates, by whom he was defeated and taken prisoner. Mithridates treated him with great cruelty, and finally put him to death by pouring molten gold down his throat.

AQUINAS, THOMAS [THOMAS OF AQUIN OR AQUINO], was of noble descent, and nearly allied to several of the royal houses of Europe. He was born in 1225 or 1227, at Rocca Sicca, the castle of his father Landulf, count of Aquino, in the territories of Naples. Having received his elementary education at the monastery of Monte Cassino, he studied for six years at the University of Naples, leaving it in his sixteenth year. While there he in all probability came under the influence of the Dominicans, who were then the rising order in the church, and were doing their utmost to enlist within their ranks the ablest young scholars of the age, for in spite of the opposition of his family, and especially of his mother (an opposition which was overcome only by the intervention of Pope Innocent IV.), he assumed the habit of St. Dominic in his seventeenth year.

His superiors, seeing his great aptitude for theological study, sent him to the Dominican School in Cologne, where Albertus Magnus, the most famous thinker of his age, lectured on philosophy and theology. In 1245 Albertus was called to Paris, and there Aquinas followed him, and remained with him for three years, at the end of which he graduated as bachelor of theology. In 1248 he returned to Cologne with Albertus, and was appointed second lecturer and *magister studentium*. This year may be taken as the beginning of his literary activity and public life. Ere he left Paris he had thrown himself with ardor into the controversy raging between the University and the Begging Friars respecting the liberty of teaching, resisting both by speeches and pamphlets the authorities of the University; and when the dispute was referred to the Pope, the youthful Aquinas was chosen to defend his order, which he did with such success as to overcome the arguments of the celebrated William of St. Amour, the champion of the University, and one of the most celebrated men of the day. In the year 1257, along with his friend Bonaventura, he was created doctor of theology, and began to give courses of lectures upon this science in Paris, and also in Rome and other towns in Italy. From this time onwards his life was one of incessant toil, and we marvel at the amount of literary work he was able to do, when we remember that during his short public life he was continually engaged in the active service of his order, was

frequently travelling upon long and tedious journeys, and was constantly consulted on affairs of state by the reigning pontiff.

The writings of Thomas are of very great importance for philosophy as well as for theology, for he is the spirit of scholasticism incarnate, and has done more than any other writer save Augustine to fashion the theological language of the Western Church. The mediæval spirit, in all its various manifestations, aimed at universal empire by way of external and visible rule. Its idea of the State was the Holy Roman Empire actually embracing and dominating over all the countries in Europe; its idea of the Church, that visible and tangible catholicity which existed before the great Reformation; and in the department of knowledge it showed its characteristic quality in its desire to embrace in one system, under one science, the whole of human thought.

AQUITANIA. This was, in the time of Julius Cæsar, the name given to that part of Gallia which lay between the Garumna and the Pyrenees, and was inhabited by a race distinct from the Celtæ. Though the greater proportion of the Aquitanian tribes made submission to Cæsar, it was not until 28 B.C. that the region was fairly brought under the Roman yoke by M. Valerius Messala. In the 3d century after Christ Aquitania was divided into three parts. *Aquitania Prima* consisted of the eastern portion of the district between the Loire and the Garonne; *Aquitania Secunda*, of the western part of the same district; and *Aquitania Tertia* or *Novempopulania*, of the region between the Pyrenees and the Garonne, or the original Aquitania. Like the rest of Gaul, Aquitania absorbed a large measure of Roman civilization which continued to distinguish the district down to a late period. About the end of the 7th century, an adventurer named Eudes or Eudon had made himself master of the region. Attacked by the Saracens, he inflicted on them a crushing defeat, but, on their reappearance, was obliged to call in the aid of Charles Martel, who, as the price of his assistance, claimed the homage of his ally. He was succeeded by his son Hunald, who, after carrying on a war against the aggressions of Pepin the Short, retired to a convent, and left the conflict and the kingdom to Guaifer (Waifer). For nine years he strenuously maintained the hopeless strife, till his assassination in 768. With him perished for a time the national independence, but not the national individuality, of the Aquitanians. The kingdom of Aquitania was bestowed by Charlemagne on the infant Louis in 781; and from him it was transmitted to his son Pepin, on whose death the Aquitanians loyally chose Pepin the younger, but were opposed by Louis, who gave the crown to Charles the Bald. Hence ensued a long period of confusion and conflict, which resulted in the comparative success of Charles, who granted the Aquitanians a nominal separation from Neustria, and gave them his son Charles, eight years old, to be their nominal king (855)—nominal, not only because he was a child, but because his kingdom was in a state of anarchy through domestic faction and foreign invasion. On his death (866), Louis the Stammerer succeeded to the titular sovereignty. About 886 Guilhem (William) the Pious, count of Auvergne, the founder of the abbey of Cluny, obtained the title of Duke of Aquitania, and transmitted it (918) to Guilhem II. He was followed in succession by Raimond Pons, count of Toulouse (d. 950), Guilhem Tête d'Etoupes, count of Poitiers (d. 963), Guilhem Fier-à-Bras, whose sister was married by Hugh Capet (970), and Guilhem the Great (977-1030), who had hard work to maintain his ground, but at last changed his title into an effective lordship. His duchy almost reached the limits of the I. and II. Aquitania of the Romans, but did not extend south of the Garonne, that dis-

trict having been ever since the 6th century in the possession of the Gascons. Guilhem refused the empire offered him by the Italians, and died at Maillezaïs. Meanwhile civilization and refinement were gradually increasing. The names of Guilhem VI. (d. 1038), Guilhem VII., who joined Gascony and Bordeaux to his duchy, and married his daughter to Henry the Black, and Guilhem VIII. bring us down to Guilhem IX., who succeeded in 1086, and made himself famous as a crusader and troubadour. Guilhem X. (d. 1137) married his daughter to Louis VII. of France, and Aquitania went as her dowry. On her divorce from Louis and marriage with Henry II. of England (1152), her possession passed to her new husband, and from that time continued to follow the fortune of the English territories in France. The name Guienne, the modern corruption of Aquitania, seems to have come into use about the 10th century.

ARABESQUE, a term to which a meaning is now commonly given that is historically incorrect. We apply it to the grotesque decoration derived from Roman remains of the early time of the empire, not to any style derived from Arabian or Moorish work; the term is therefore a misnomer. Arabesque and Moresque are really distinct; the latter is from the Arabian style of ornament, developed by the Byzantine Greeks for their new masters, after the conquests of the followers of Mahomet; and the former is a term pretty well restricted to varieties of cinquecento decoration, which have nothing in common with any Arabian examples in their details, but are a development derived from Greek and Roman grotesque designs, such as we find them in the remains of ancient palaces at Rome, and in ancient houses at Pompeii. These were reproduced by Raphael and his pupils in the decoration of some of the corridors of the Loggie of the Vatican at Rome: grotesque is thus a better name for these decorations than Arabesque.

We will first briefly describe the Saracenic, as the elder sister of the two styles, which was ingeniously developed by the Byzantine Greek artists for their Arabian masters in the early times of Mahometan conquest. Every natural object was proscribed; the artists were, therefore, reduced to making symmetrical designs from forms which should have no positive meaning; yet the Byzantine Greeks, who were Christians, managed to work even their own ecclesiastical symbols, in a disguised manner, into their tracery and diapers; as the lily, for instance. The cross was not so introduced; this, of course, was inadmissible; but neither was the crescent ever introduced into any of this early work in Damascus or Cairo. The crescent was itself not a Mahometan device till after the conquest of Constantinople in 1453 A.D. The crescent, as the new moon, was the symbol of Byzantium; and it was only after that capital of the Eastern empire fell into the hands of the Turks that this symbol was adopted by them. The crescent and the cross became antagonistic standards, therefore, first in the 15th century. And the crescent is not an element of original Moorish decoration.

Such is the genuine Arabesque of the Arabs, but a very different style is now implied by the term—the Arabesque of the cinquecento, a purely classical ornamentation. This owes its origin to the excavation and recovery of ancient monuments, and was developed chiefly by the sculptors of the north, and the painters of Central Italy; by the Lombardi of Venice, by Agostino Busti of Milan, by Bramanti of Urbino, by Raphael, by Giulio Romano, and others of nearly equal merit.

ARABGIR, or **ARABKIR**, a town of Turkey in Asia, in the vilayet of Sivas, situated in a deep ravine near a small tributary of the Euphrates, 150 miles S. S. W. of Trebizond.

ARABIA is a peninsula stretching from north-west to south-east, between 30° and $12^{\circ} 45'$ N. lat., and between $32^{\circ} 30'$ and 60° E. long. Its form is that of an irregular parallelogram, almost a triangle indeed, bounded on the W., S., and E. by the Red Sea, the Indian Ocean, and the Persian Gulf respectively; on the N., where runs its narrowest limit, it joins on to the mainland of Syria. Its correct boundary in this direction would be assigned by a line drawn transversely, west and east, from Suez to the head of the Persian Gulf. But some writers, Burckhardt included, add to this extent all the Syrian desert behind Palestine, and the valleys of the Jordan and Orontes up to the village of Anah, on the Euphrates, 34° N. lat.; and then down again by the right bank of that river to where, joined by the Tigris, it takes the name of Shatt-el-Arab, and so to the Persian Gulf again. Roman geographers make Arabia the further present of Mesopotamia; and Abul-Feda, an Aleppine of the 13th century, would even bring its denomination so far north as to include Aleppo. We will, however, accept the first-mentioned as the most correct line of demarcation. According to this, the extreme length of the Arabian peninsula, from the head of the gulf of Akabah to the straits of Bab-el-Mandeb would be about 1300 miles; its greatest breadth, in 23° N. lat., from the Red Sea coast, west, to Ras-el-Hadd, east, 1500 miles; and its apex, where it joins on to the continent of Asia, rather under 900 miles.

The western coast is washed by the Red Sea. It exhibits a range of low mountains, seldom exceeding 2000 feet in height, abrupt in outline, and generally barren; between them and the sea is a narrow and sandy strip fringed along the margin with coral reefs. Its aspect from the sea is almost everywhere desolate in the extreme. Nor does the entire coast-line present a single harbor, properly speaking, where anything larger than an ordinary schooner could find entry; only roadsteads, the approaches to which are often rendered difficult by shoals and reefs. The Arab side of the Red Sea, especially in the southern half, is thickly studded with small islands, some of which — Kotembel and Pebel Tar in particular — are of volcanic origin. A few fishermen inhabit some of them; but none — the island of Perim, near the entrance of the Bab-el-Mandeb straits, lately occupied by a British garrison, alone excepted — are of any importance.

The south-eastern coast, extending from Bab el-Mandeb up to Ras-el-Hadd, is not less dreary than that of Hejaz in appearance, and, like it, presents a low and barren mountain range, diversified only by jagged rocks amid tracts of sand; but it possesses several good harbors — that of Aden in particular, now a British coaling station, about 100 miles east of Bab-el-Mandeb; that of Dafar, further up; and that of Keshum; though the two last, owing to the want of traffic with the interior, now serve as mere ports of refuge. Along this shore lie several islands, the largest being that of Mozeyrah, near Ras-el-Hadd, but they are only the haunts of a few half savage fishermen, or are wholly desert.

The third coast, reaching from Ras-el-Hadd to the top of the Persian Gulf, is of a more cheerful character. Its easterly half, from Ras-el-Hadd to Cape Musandam, is in general fertile, well cultivated, and backed up by the lofty forest-sprinkled chain of Jebel Akhdar, or the "Green Mountain." Here is situated the excellent harbor of Mascat, one capable of admitting the largest vessels to an almost land-locked shelter; besides other smaller but secure ports. Passing Cape Musandam to the west and north, the coast, though low and sandy in some places, is in others, palm-fringed and cultivated; and the neighborhood of the shallow harbor of Kateef,

opposite Bahreyn, is especially fertile. Near the head of the gulf is the harbor, a very good one, of Koweyt, called also Grane. It furnishes the best ships and sailors of these seas. Many islands stud the Gulf Ormuz, famous in Persian, and, later, in Portuguese history. Near the narrow entrance, by Cape Musandam, not far off, extends Iishm, a large and fertile island; higher up lie side by side the sister islands of Bahreyn, Menaneh, and Moharrik, where commence, and continue eastward all along the neighboring coast of Katar, the most productive pearl fisheries in the world. But countless shoals and reefs render the navigation of the Persian Gulf scarcely less dangerous than that of the Red Sea; storms, too, often arise suddenly on its waters, and shipwrecks are of frequent occurrence.

Arabia, taking it as a whole, cannot be called a fertile country. Its general features are those of an elevated table-land, backed up by low mountains to the west, and gradually rising in the direction of the east and south, where we find it bordered by a second and loftier mountain range. The mountains, if we except Jebel Akhdar in Oman, are almost wholly barren on their sea side; but are occasionally fertile enough on their inner ranges, especially in Yemen and the southerly districts. Their outlines are rugged and precipitous to a degree that, joined with the refraction of an over-heated atmosphere, gives them from a distance the appearance of being of a much greater height than they really are. Behind them lies an uninterrupted ring of sterile desert, broadest on the south and east, where it expands into a huge waste of burning sand; narrower towards the west and north, where it is more rocky in its character. Within this belt rises a series of table-lands, undulating in long slopes, and intersected with deep valleys; the former rich in pasturage, the latter in field and garden produce. This central plateau constitutes about one-third of the total superficies of the peninsula; the desert ring another third; the coast ranges make up the rest.

In describing Arabia, the ancients, whose knowledge on the subject was slight, were accustomed to lay down an imaginary tripartite division, founded on the natural qualities of those districts with which they were more or less acquainted; and accordingly portioned off Arabia into Petraea, Deserta and Felix, or the Stony, the Desert and the Happy; without, however, assigning any very distinct boundaries to these regions. More modern geographers, Eastern and European, have, with better but still inadequate information, either multiplied or confounded the main divisions of the peninsula. Much indeed of its surface is even now unknown to us, except by the uncertain hearsay of Arab narrators. However, the ground-plan laid down by Niebuhr, the most accurate and painstaking of travellers, is substantially correct, and has been so often confirmed, never invalidated, by later discoveries, that we may safely follow its indications.

Beginning from the north-west, the first district we meet with is that of the Sinaitic peninsula, a small triangle having its apex on the Red Sea, its base on Palestine, and its sides formed by the Gulf of Suez on the west, and that of Akabah on the east. It is a mere collection of naked rocks and craggy precipices, intersected by long narrow defiles and sandy valleys, in which tamarisk bushes, dwarf acacias, thorny shrubs, and some kinds of euphorbia, are almost the only vegetation; in a few favored spots a cluster of wild date-palms may occasionally be met with; and the scanty soil after the spring rains becomes sprinkled over with thin blades of grass that the summer suns soon wither. The hot wells near Suez, called "Eyoon Moosa," or the "Fountains of Moses," are well known; as also are those entitled "Hammam Pharaon," or the "Bath of

Pharaoh," the waters of which resemble in their contents those of the Dead Sea.

The second geographical district is that of the Hejaz, along the eastern shore of the Red Sea, and extending inland for a distance varying from sixty to a hundred and fifty miles. It consists of a continuation of the Sherá mountain range, with a narrow sandy slip of level ground towards the sea and a hilly plateau on the inland side, broken by bare and fantastic rocks.

The southernmost extremity of this region, marked off as the "Haram," or Sacred Territory, but in its physical characteristics identical with the rest, contains the town of Mecca.

With Hejaz we may also reckon, topologically speaking, the oases of Jowf and Douma, situated to the north-east, both formed by broad and abrupt depressions in the inland plateau, and surrounded by a wide-spread wilderness of rock and sand.

Of plants there is an endless variety, but insufficiently known, for Arab botany has yet to be investigated. "Samh," a small mesembryanthemum, from the grain of which the Arabs prepare a sort of porridge that serves them in lieu of bread; "Mesaa," a thorny bush that bears a subacid berry not unlike a currant in appearance and flavor; "Nebek," the *Rhamnus lotus* of botanists; many kinds of euphorbia, absinthium, and the bitter colocynth, used by the Arabs for medicine, grow wild everywhere. The tamarisk or "Talh," the southern larch or "Ithel," the chestnut, the sycamore, and several other trees, the wood of which is, however, too porous and brittle for use as timber, are natives of Hejaz; so also is the wild dwarf date-palm, the almond, the pomegranate, and the "gum-arabic" tree, a graceful and delicate acacia. Fine grass, intermingled with various aromatic herbs, springs up in patches between the stones and among the sand; but the want of sufficient rainfall and the dryness of the atmosphere prevent any really profitable vegetation, except in the few oases already mentioned. Taking it as a whole, the Hejaz is, with the exception of the actual and recognized desert alone, the most hopelessly sterile district in the whole Arabian peninsula.

Following the Red Sea coast down to its southernmost extremity at Aden, we have in view the third great geographical section, that of Yemen. It includes two regions, sea-shore and inland, the former of which is commonly called the "Tehamah." This is a wide strip of coast left by the mountain chain, which, continuing on from the Hejaz, runs down as far as Aden, but hereabouts recedes somewhat to the east, thus forming an arc, in the curve of which lies the Tehamah. The mountainous district extends far inland, and gives out several branches, some of which reach about three hundred miles to the east.

Tehamah is, as might be expected from its topical and geographical conditions, a very hot region; it is one also of but moderate fertility, though the soil, an agglomeration principally of coral debris, is less absolutely barren than that of Hejaz. The rains here are periodical, their fall coinciding with the epoch of the Indian monsoon; they give rise to numerous torrents, that traverse the plains, and some of which hardly dry up throughout the year. The coast-line is indented by several small harbors and roadsteads; intricate coral reefs render the approach everywhere difficult, often dangerous.

Yemen, under which name the whole south-western quarter of the peninsula is popularly included, possesses many advantages, both of climate and soil, denied to the greater portion of Arabia. It is a highland country, formed by a labyrinth of precipitous hills and fertile valleys. The air is pure and even cool; the seasons are as regular as those of eastern India, and succeed each

other in much the same order. No accurate survey has yet been made to determine the elevation of its mountains, some of which have been roughly, but perhaps incorrectly, estimated at five thousand feet in height; their general direction is from north-west to south-east. The largest plains, or plateaus, inclosed by them are that of Nejran on the north, that of Sanaá to the south, and that of Mareb on the east, on the frontier of the great desert. The oasis of the southern Jowf, a basin-like depression occurring in the sandy waste that reaches inland from the high grounds of Yemen up to Oman, on the other side of Arabia, may also be reckoned as belonging to Yemen.

It is in this region that Arabian vegetation obtains its most varied, as also its most valuable development. In the neighborhood of Medinah commences the great date-palm belt that crosses the peninsula, and extends southward as far as lat. 23° in full vigor. A hundred and more varieties of this tree are said to grow in the immediate vicinity of Medinah alone: the quality of the fruit varies for each kind, as also do its size, color, and flavor. The poorest of all, the "sihane" date, a yellow, stringy fruit, is much eaten by the Bedouins; the "birnee" is the red and succulent; the "jebelee," an upland date, is a staple article of export. Nejd is, however, the favored land of date-palms: every valley that intersects its vast plateaus waves with them, and the fruit, which often attains a length of two inches, with a proportionate thickness, far surpasses the best products of Hejaz in lusciousness as in size. Eaten fresh or stewed with butter, they form the staff of Arab food; and the pulp, after the kernels have been extracted, close-pressed and half-dried, is exported under the name of *ajweh* to almost every part of the East.

Besides the date tree, the "doom," a fan-leaved palm bearing a large fibrous and sweetish fruit, is not of uncommon growth in the central and southern districts; while the cocoa-nut and betel are planted, though not to such an extent as to reckon among the articles of ordinary cultivation, along the southern and eastern coast. So are also the banana, the papay, and the Indian fig; but all these are of recent importation from the opposite coast of India. Vines are cultivated throughout Arabia, and have been so from time immemorial; and though since the well-known prohibition of the Koran the grapes are no longer pressed for wine, they are in great request as an article of consumption, both fresh and dried. Senna, an article much used by the Arabs in their rough medicine, grows in the southern Hejaz and the Tehamah; so also does the balsam tree, the best of which is indigenous to the district of Safra, near Mecca; its gum is sold even within Arabia itself at a high price.

But although the Arabs themselves consider the date-palm the special pride and ornament of their country, a more general verdict would probably be given outside of Arabia itself in favor of the coffee plant. This shrub is by some supposed to be indigenous to Abyssinia; it has, however, for several centuries attained its most extensive distribution and its highest standard of produce in Yemen, where it is cultivated throughout about half of the upland district, the best quality of berry being that which ripens on the western slopes of the mountains in the neighborhood of Sanaá.

Next to Yemen, and lying along the coast of the Indian Ocean, from Aden to Cape Ras-el-Hadd, a distance of 1200 miles, are situated the provinces of Hadramaut and Mahrah, the former mentioned in Genesis under the name of Hazarmaveth, and more celebrated in ancient Arab chronicles, and in the notices of Strabo and Ptolemy, than it has been in later times. This coast has been visited and even partially explored by Captain Wellsted and other navigators.

From Ras-el-Hadd to the extreme northern limits of Arabia, at the head of the Persian Gulf, the provinces of Oman and Hasa complete the sea-coast. Oman is a mountainous district, its principal range, that of Jebel Akhdar, or the "Green Mountain," so called from the abundant vegetation that covers its sides, reaches an ascertained height of 6000 feet; several other minor chains run parallel with it and with the coast; the plains beneath them are well watered and fertile, though, like every other part of Arabia, destitute of running rivers or streams, the want of which is here atoned by copious wells and springs, running over into large pools, and supplying an extensive system of irrigation.

Near Cape Musandam, at about 406 miles north-west of Ras-el-Hadd, the mountains (which, averaging in this promontory from 2000 to 3000 feet in height, come down in precipices to the sea edge), are intended with numerous deep creeks and bays, several of which afford good anchorage and shelter,—only they are cut off by the steepness of the surrounding cliffs from inland communication.

Owing to the rapid interchange of heat and cold occasioned by the peculiar situation of the gulf between the torrid levels of Arabia on the one side, and the high, not infrequently snow-capped, mountains of Persia on the other, the climate of this coast is remarkably irregular in its seasons, and subject to sudden storms of great violence, with heavy rains. It is also decidedly unhealthy; and low fevers, sometimes of an intermittent, sometimes of a typhoid type, are never absent from the villages.

Indeed the whole of the Arabian sea-shore, which we have now thus summarily surveyed, partakes more or less of the same unhealthy character, one often noticed by travellers, and experienced by some of them with fatal effect. We have seen, too, that in general outline it offers little variety, being mostly mountainous, especially in its southern part, with a narrow and rarely fertile shore-fringe; while the mountains themselves vary in height and extent, being at their loftiest and widest in Yemen and Oman, where their rich vegetation, joined to a pure air, and a climate tempered by the elevation, offers an agreeable contrast to the dissimilar qualities of the coast itself, narrower and more barren elsewhere.

We have now to consider the central plateau, or Nejd, an important region, regarded by the Arabs themselves as peculiarly their own—the stronghold of their vigorous nationality, and the birthplace of their most cherished traditions and institutions.

It is girded on every side by a broad desert belt, which the traveller must of necessity cross before he reaches the inner region. It is this very desert that, having been often witnessed on its outer rim, but never traversed from one side to the other by Greek or Roman, or even, in the greater number of instances, by modern explorers, has given occasion to the belief that central Arabia was itself a little better than an expanse of uninhabitable waste—an idea expressed by the *Arabia Deserta* of the ancients, and often repeated by later writers.

This desert, on the north and north-east, where it extends from Syria and the Hejaz inwards, is a region of hard gravelly soil, from which circumstance it has derived the elastic title of "Petraea." It is diversified here and there by belts of sand, with occasional patches of stunted bush and thin grass, indicative of moisture at some depth below; the sand, too, affords rooting for a feathery euphorbia, the "ghada" of the Arabs, a favorite browse of camels. The general height of this tract, backed up as it is by the Syrian plateau on the north, and the Sherā mountains on the west, appears to vary from 1000 to 2000 feet above the sea. Eastward it

slowly slopes down to the level of the Persian Gulf. A long serpentine depression, beginning in the Syrian territory near Palmyra, traverses it in a south-easterly direction; this is Wadi Seihan, or the "Valley of the Wolf," leading to the deep oval hollow of Jowf, with its oasis of palms and gardens. A more extensive but shallower depression to the west forms the oasis of Teyma, known to Hebrew chroniclers. South of Jowf and Teyma the desert changes its stony to a sandy character, and its surface is heaped up by the winds into vast ridges, called the Nefood or "passes," not to be crossed without some danger; for, besides the almost absolute want of water, a few scanty and brackish wells of which, separated from the other by intervals of 60 or more miles, alone exist, it is here that the "simoon," or poisoned wind, often blows—a phenomenon entirely distinct from the customary "shelook," or sirocco, of the south, much as a hurricane differs from an ordinary gale, though the two have been occasionally confounded in popular writings. The simoon is a peculiar condition of the atmosphere, resembling in all essential points a cyclone. As in the cyclone, the central space, or the simoon itself, is calm, but is occupied by a gas unfit for respiration; while around this is a centre, slowly travelling on, there eddy violent gusts of heated air, like those of a furnace, though it is not to them, but to the comparative vacuum which they surround, that the simoon owes its suffocating qualities. It approaches slowly amid the whirl of air currents that precede it for some distance; its violet color announces it when actually near. During its presence the only chance of preserving life till the mephitic vapor has passed over, is found in covering the face with a cloth and lying prone on the sand, thus to inhale what little atmospheric air still exists in the upper ground stratum, and thus to maintain the breath till the period, varying from two to ten minutes, of the poison column be gone by; meanwhile the feeling in the chest is that of suffocation, and that in the limbs as if molten iron were being poured over them. Camels instinctively bury their muzzles in the sand during the simoon; but horses are said not to possess the same preservative instinct, and to perish in consequence. The precise nature of the phenomenon, and its origin, are subjects of conjecture; but its general character, that of an eddy of heated atmosphere around a central space occupied by a deleterious gas, the whole travelling at a slow rate, and generally from south or east to north and west, is not to be mistaken.

Beyond Hareek, or "Burning," as the name means, to the south, as also behind Wadi Dowasir and its neighborhood, lies the great Arab desert or Dahna, "The Red" as the Arabs call it,—a vast extent of sand, said to cover nearly 50,000 square miles, and only jotted here and there at far intervals by a few clustered bushes or dwarf palms, indicative of moisture below the surface, else wholly desolate. Its surface is ribbed into huge sand waves, the principal ones being from north to south,—that is at right angles to the prevailing wind, which is here the east; but these main waves are again crossed, intersected, and jumbled with other less regular undulations, the work of more variable breezes.

But neither here nor elsewhere in Arabia do these clouds or columns of moving sand, the terror of caravans, appear, that have been fabled by travellers and poets. Tracks are indeed speedily covered and effaced, to the great annoyance and occasional danger of the wayfarer; but neither he nor his beast run the least risk of being thus buried alive. Hunger, and, still more, thirst, are sufficient guardians of a region, to which, however, Arab fancy has attributed the additional protection of evil spirits and monsters of death.

This greater desert, the "Roba el Khaliyeh" or "Empty Space" of geographers—the "Dahna" or "Crimson" of modern Arabs, so called from the prevailing color of its heated sands,—extends to Yemen and Hadramaut on the south-west, south, and south-east, and to Oman on the east. It is separated, however, from the northern half of the waste-ring that girdles Nejd by the continuation of Wadi Dowasir and Shahrān, up to the mountains of Tayef, near Mecca; and this is the only line by which the plateau of Nejd can be reached from the coast without actually crossing the sandy or stony wilderness. Lying as it does on or within the tropics, the heat of this great desert is said to be fearful by day, and, owing to the general low level, to be scarcely mitigated at night. But it is never traversed in its full width, not even by Bedouins; and little or no credit can be attached to the relations of those who pretend to have explored it, and to have found wonders in its recesses.

Throughout the highlands of Nejd the climate, though often hot by day, is cool and pleasant by night; the spring and the autumn rains seldom fail in their seasons; and the soil, where not artificially irrigated, produces excellent pasture,—where irrigated, it renders very tolerable garden produce and field crops. Storms of thunder and lightning are of rare occurrence, and the tornadoes that from time to time visit the Arabian coasts are here unknown. The prevailing, as also the most refreshing winds, are from the east and north-east; the south and west winds are heated and unwholesome. Epidemic diseases are rare, and only one visitation, and that not a severe one, of cholera is on record within Nejd.

Summing up,—Arabia may roughly be divided, as to its surface extent, into a third of coast-ring and mountains, part barren, part either cultivated or susceptible of being so; another third of central plateau, also tolerably fertile; and a third of desert circle, intervening, with only one gap, that in the latitude of Mecca, between the first and second. The central space, whether plateau or desert, varying in height from 1000 to 3000 feet above the sea, possesses three important mountain ranges,—two transverse, namely, Jebel Shomer and Jebel Ared, and one vertical, that commences with Toweik, and is continued by the Akhaf,—these latter being the watershed of the peninsula, the general rise of which is from west to east. The highest mountain peaks—those, namely, of Jebel Akhdar in Oman—do not apparently exceed 6000 feet.

In a description of the animals of Arabia the first place is undoubtedly due to the horse, which, though the opinion is unsupported by scientific evidence, has by some been supposed to be indigenous to the peninsula. As a fact, it is here that this animal attains its highest perfection: not, indeed, that of size; for a true Nedjee of the best and purest breed seldom reaches and never perhaps exceeds fifteen hands in height; nor that of mere speed, for a trained European racer would easily distance a thoroughbred Arab on any ordinary course; but for perfection of form, symmetry of limb, cleanness of muscle, beauty of appearance—for endurance of fatigue, for docility, and for speed maintained to distances so long as to appear incredible, the Nedjee horse acknowledges no equal. The animal is too well known to require minute description on the present occasion; but it is important to have a clear idea of the principal divisions of its race and kind, which have been strangely and even injuriously confused by many writers.

Tradition assigns the origin of the present Arab stock to Yemen, but historical records, dating as far back as the 5th century, show that the best quality and the greatest number of horses were then to be found exactly in the same district where they now exist, namely, in Nejd.

Secondly, a few thorough-bred Nejdees have crossed the frontier as presents. In this manner, Teysul, the late monarch of Nejd, sent forty head from his own stable as an honorary tribute to the reigning Ottoman sultan, Abdel-Azeez; and similar offerings have been now and then made, as fear or other motives may have dictated, to different other governments, and even to distinguished individuals. But mares are never given away thus; only stallions.

Reared under an open shed, and early habituated to the sight of men, to the sound and glitter of weapons, and to all the accessories of human life, the colt grows up free from vice and timidity, and even acquires a degree of intelligence that surprises a stranger. Barley and dates are the chief stall provender; but the grass of the pasture-grounds, in the selection of which much care is taken, is the ordinary nourishment of an Arab horse. Of water the allowance is always kept purposely scant. A good Nejdee will canter for four-and-twenty hours in summer-time, and eight-and-forty in winter, without once requiring drink. Raw meat, dried, is occasionally given in small quantities when extra exertion is required; lucerne grass is employed for lowering the tone. Geldings are very rare. The color that most frequently occurs is grey; then comes chestnut; then white and sorrel; mottled grey and black are now and then to be found; dark bay never.

Colts are ridden early—too early, indeed—in their third or even second year, and are soon broken in to a steady walk, to a canter, and to the ambling pace which is a special favorite with Arab riders; racing, an Arab amusement from time immemorial, and the game of "jerzed," a kind of tournament or mock fight with blunt palm-sticks, highly popular throughout the peninsula, complete the training both as to wind and pace. Saddles are seldom used in Nejd, and stirrups never, but both are occasionally employed in the Hejaz and Yemen. So it is also with bits, the place of which is taken in Nejd by halter-ropes, the real guidance of the animal being almost wholly effected by the pressure of the rider's leg and knee. Shoes, too, are of rare occurrence, nor are they needed in the light and sand-mixed soil of the central provinces; on the other hand, the hoofs are often rubbed with grease, to counteract the drying effects of the heated ground. Of all niceties of grooming, docking and clipping excepted, Arabs are masters; and their natural kindness to animals, a quality which they share with most Orientals, together with the care which every reasonable man bestows on a valuable article of property, ensures to an Arab horse a good treatment at the hands of his owner. But Arab horses do not commonly enter tents, nor play with women and children, nor, in a general way, do they share family meals, nor are they habitually kissed and cried over, as the imagination or credulity of some narrators has suggested. An Arab, flying for his life, has indeed been known to give the only morsel of dry bread about him to his horse rather than eat it himself,—an act in which self-preservation had probably as large a share as affection. Lastly, the standing prohibition of horse-selling from Nejd has really nothing more romantic in it than a narrow-minded application of the principles of protected monopoly; in other cases, reluctance to conclude a bargain simply indicates that the offer made was considered insufficient.

Below the horse in popular estimation and market value, but far above him in general utility so far as Arabia is concerned, comes that eminently Arab animal the camel. Of these there are many varieties: the best, swiftest, slimmest in form, and most docile to guidance, is the "hejeen," or dromedary. It is almost exclusively employed for riding, whereas the "ibl," or ordinary camel, readily distinguished from the other by a coarser

build, a slower pace, and a less tractable disposition, is a beast of burden, and indeed is employed for all purposes. This species is very commonly, too, kept and reared for the sake of its flesh and milk, precisely as horned cattle are elsewhere; in fact, boiled camel's meat is the most ordinary article of animal food throughout the peninsula,—it is a flabby, tasteless dish, not unlike the poorest sort of beef; any flavor that it may possess is musky and disagreeable. The milk, on the contrary is excellent, equal in quality and in sanitary properties to that of the she-ass, but neither butter nor cheese are made from it. The wool, which in the camels of Nejd and Oman is remarkably soft and fine, serves for making articles of dress, into which it is woven, sometimes alone, sometimes mixed with wool; it is much superior to sheep's wool in every respect. The ordinary color of the animal in the northern Arab provinces is a reddish brown, but in Nejd and throughout the south, lighter tints, varying from grey to white, are more common; black is extremely rare, and highly esteemed. The least valuable breeds are those of the north and west,—that is, those of the Jowf, of Shomer, of the Hejaz, and of Yemen; in Nejd, which region, from the number of its herds, is sometimes called "Omm-el-Ibl," or "the Mother of Camels," the species improves; but all agree in assigning the palm to the dromedaries of Oman. In fine, all over Arabia, whether among the Bedouins or the villagers, camels are the principal staple of traffic, the favorite investment of wealth, and the ordinary standard of property.

Camel or dromedary, the Arabian animal has only one hump, which increases or diminishes in size according to the general good or bad condition of the beast. On this hump the saddle—called, if a riding one, "ghabeet;" if one for baggage, "shedah"—is placed; a halter is the only rein employed, though even this is more commonly dispensed with by the Arabs, who simply direct the animal by a kick of the heel or a blow about the neck with the "mihjan," a small crooked stick carried in the rider's hand. The average travelling pace, an amble between five and six miles an hour, and this a good dromedary will continue for fifteen hours out of the twenty-four during a week together. Six days in the summer, ten in the winter, form the longest period that the dromedary can continue to pace without a fresh supply of water; and hence an "ashavee" or "tenner" is the title given to the best of the kind. Two hundred-weight is the average load of the Arab carrying camel.

No animal puts its owner to less expense for its keep: the thorn of the desert, dry grass, cactuses, euphorbias, nothing comes amiss to a camel's appetite; a ball of paste weighing about a pound, and made of barley-meal and water, is given every evening when extra work has to be done.

An average duration of a camel's life is thirty years, that of a dromedary somewhat less; the price of either varies from about £4 to £80, according to quality, those of Oman commanding the best market. But although the camel, whether as an article of use or of sale, is far more important to Arabia than the horse, it is in intelligence and docility immeasurably inferior to the latter animal, never becoming attached to, or even, seemingly at least, acquainted with its owner; and never obeying except perforce and under protest.

Next to camels, sheep and goats form an important item of Arab wealth. The best sheep are the piebald and large-tailed ones of Yemen; those of Nejd, too, are in great request on account of their flesh, which is excellent, though their wool is confessedly less fine in quality. Some districts of Oman produce a silky-haired breed not unlike that of Angorah. The least esteemed sheep are those of Hejaz and the north; but, in compensation, the

goats of these provinces are longer-haired and generally better than those of the south; they are black, with long drooping ears. Spring is the shearing season in Nejd, but the wool is seldom exported, being mostly bought up for local use. From the milk of these animals butter and a white insipid kind of cheese are made: both are articles of daily consumption in Arab households.

Cattle are reared throughout Arabia, but owing to the prevailing deficiency of deep and succulent pasturage their number is not so considerable as that of the camel. Cows and oxen, throughout Nejd, Oman, and Yemen, bear on their shoulders a hump analogous to the well-known one of the so-called "Brahminee" bull; the ordinary color is dun; their legs are slender, the horns short, and the whole stature diminutive. The kine of the northern provinces are stouter and yield more milk; they have no hump. Buffaloes are also kept in the marshy districts that occur in Yemen and Oman. They differ in no respect from the Indian breed; but, unlike oxen, these animals cannot be reckoned in the ordinary list of Arab farm stock, as they exist only in exceptional circumstances, whereas a few kine may be found in almost every village, and the irrigation of the fields and gardens is mostly done by means of oxen.

Like the horse, the ass attains its greatest excellence in Arabia, where it is more often employed for riding than for loads; indeed, in some provinces, especially in Hasa, it is the usual mount even of the wealthy. The best species is that reared in Hasa and eastern Nejd, where these animals are generally of the purest white in color, and stand from eleven to thirteen hands high. In pace they scarcely yield to an average horse. They are often exported and sold at high prices in Egypt or at Constantinople, a single animal fetching from £40 to £80. They are ridden in Arabia with side-saddles. Good asses are to be found also in the other districts of Nejd, in Yemen, even in Hejaz; their ordinary color is grey. The same animal runs wild in many of the open and mountainous regions of Arabia, and is hunted for the sake of its skin by the Bedouins; but the onager or zebra of Cutch is not met with in this peninsula.

Mules and hinnies, common throughout Syria and Mesopotamia, are extremely rare in Arabia proper, where a prejudice exists against their use.

The Arab dogs differ very little from a jackal in appearance as in habits; its muzzle is pointed, its color sandy, and its long and somewhat bushy tail is curled over the back. When domesticated, the breed improves, approaching the European wolf-dog; these animals, by training, become very tolerable indoor and outdoor guardians, both of flocks and herds and of dwellings, and in this capacity they are to be found everywhere, both in the towns and villages and in the open country, where they are not less useful to their masters than annoying to strangers. Another kind of dog, belonging to the greyhound species, and evidently of exotic origin, is often reared in Arabia; the swiftest and most enduring of this kind are from the province of Hasa. They are in great favor as harriers.

Arab cats differ in no respect from their congeners in Europe except in being rather smaller. The house-mice too are absolutely the same; but the rat is more akin to the old black species of England, now nearly extinct.

Wild animals are not very numerous in any part of Arabia proper, a fact which is sufficiently accounted for by the want of running streams and open pools, as also by the thinness of cover and forest growth; yet the records of the country make mention of the existence of some kinds of beasts which have subsequently disappeared altogether. Thus the long-maned lion, and, it would appear, a large kind of ape resembling the

African gorilla, often mentioned by the early writers, are no longer to be found in the peninsula. But a small tiger, formidable from its ferocity even to man, is still met in the wild hilly regions north of Nejran, and again in the inland recesses of the Oman mountains; while the "fahd," or panther, belongs to no particular province; it haunts the neighborhood of villages, and devours the smaller stock. Lynxes have been seen in the Hejaz and Nejd; wolves are common in the mountains, and sometimes descend to attack the flocks in the open plains. There are foxes too, but small and greyish in color. The Arab hyæna is large and fierce; it is said, when pressed with hunger, to be dangerous even to men, and figures in many a story of Arab adventure. Jackals are more numerous in the northern than in the southern districts. Small black-faced long-tailed monkeys are to be met with by herds in Yemen, and even, though less often, in Nejd. A pretty little beast, the "yerbooa," jerboa, or kangaroo-rat, burrows in the sand, and comes out to look with great curiosity on passers-by; its hind legs, long, and provided with equally long feet and toes, are out of all proportion to the shortness of its forepaws; its motion, especially when pursued, is like that of the kangaroo, and is performed with the help of its long sinewy tail. Its color, partly fawn, partly white, is very agreeable to the eye. The Arabs eat its flesh, which resembles that of the rabbit.

Of the deer tribe the gazelle is the most common; it abounds not only in the open grounds, but even among the villages and near the towns. It is sometimes, but not often, hunted by the natives. Chase is more often given to the mountain goat, partly on account of its flesh, which is excellent, partly for the sake of its long recurved horns, which are like those of the Alpine steinbock, only larger. But the hare, which is coured with dogs, and which resembles the European animal in every respect except size, for it is smaller, is the favorite game of the Arabs, who, unlike the Persians and Turks, have no scruple as to the use of the meat.

The ornithology of Arabia is copious, but has been little studied. Birds of prey, grey eagles, vultures, bustards, and sparrow-hawks, abound in the open lands; while partridges, especially of the mottled kind called "kata," are to be seen crossing the desert in quest of water by flocks; quails frequent the mountain districts in immense numbers, so also do rock-pigeons, wood-pigeons, and a species of wild guinea fowl; wild ducks are met with in plenty along the coast. Cranes, larks, sparrows, finches, and the like, frequent the cultivated lands; so also does the hoopoe, a bird held in high honor by the Arabs on account of its traditional services as messenger between Solomon and the Queen of Sheba or Belkeys. A large mottled thrush, also considered to be of good omen, is seen everywhere. Flocks of swallows, the flight of which is invariably from the east, pay annual visits to Arabia, where they are very useful in diminishing the swarms of locusts, their favorite food; one species of this bird appears, however, to be indigenous to Yemen. Peacocks and parrots are also found in the southern provinces, and in Nejd, Hasa, and Oman; hawks are kept by many, and are carefully instructed for the purpose of falconry.

But the most remarkable bird of Arabia, and the only one which forms a regular object of chase among the natives, is the ostrich. Its extreme timidity, joined to the swiftness of its pace—for although it does not fly, it assists its running by the movement of its extended wings—renders it in vain for the hunter to attempt overtaking it on horseback; he therefore seeks to approach it generally when on its nest by artifice, and kills it by a long shot; sometimes he snares it by a running noose. The feathers, the best of which belong to

the male bird, are sold at Damascus or Baghdad; the eggs are eaten, and the shells are used for ornament. The finest ostriches are those of the neighborhood of Shomer and the uplands of Toweyk; they are often to be seen, but at a safe distance, scudding across the sands in a file of twenty or thirty at a time.

Reptiles, except those of the lizard species, are comparatively rare in Arabia, though serpents are occasionally met with; but, except the "afai" and the "rukta," both snakes of the viper class, the former brown and the latter banded, and considered the deadlier of the two, none are venomous. Boa-constrictors, resembling the Indian rock-snake, have been also seen,—none, however, large enough to warrant the wonderful stories told about them by the Arabs themselves, whose love of the marvellous often leads them beyond the limits of truth.

Insects are, however, numerous enough; little scorpions, scarce an inch in length, but capable of inflicting by their sting extreme pain, swarm in the desert sands; and large ones, four or even six inches long, infest the houses. Centipedes, too, are common; wasps and wild bees tenant the rocks; flies are troublesome everywhere, and mosquitoes on the coast; ants of all kinds, some enormous in size and venomous in bite, are to be found here; and a very poisonous spider, called, for its double pinchers, "aboo hanekein," inhabits the crevices of old walls on the western coast, and is much dreaded by the natives. Scolopendras, too, are not rare. It is some compensation, however, for these serious yet only occasional inconveniences, that no fleas or bugs exist in any part of Arabia. But—a serious drawback—the "arda," or white ant, the *Termes fatalis* of Linnæus, is hardly less troublesome and destructive in the southern provinces than in India itself. Lastly, vast swarms of locusts, larger and darker in color than those commonly seen further north, often infest the peninsula, and commit grave ravages, especially when, as too frequently happens, their visit is in the spring or early summer. Their course is usually from east to west. However, the Arabs, by converting these insects into an article of food, make up to themselves in some measure for the damage suffered by the crops and pastures; indeed, locusts, boiled and slightly salted, are a favorite article of sale in every Arab market, but particularly in Nejd and the eastern districts.

The soil of Arabia varies according to the character of its rocky substratum. All round the coast, and to a distance corresponding with the breadth of the girding mountain chain to the interior, it is formed of volcanic and metamorphic detritus, with patches here and there of a calcareous character, due to the upheaval and decomposition of old coral banks. Such a soil cannot but be tolerably fertile, and it would be more so were the scantiness of rain made up for by a more systematic artificial irrigation. A second inconvenience is caused by the encroachments of sand, which is at times drifted by the winds from the desert inland in such quantities as to become seriously injurious to cultivation. Behind the mountains the surface of the desert to the north and west is that of gravelly expanse, thickly sown over with flint and quartz; while to the east and south it is an almost unalloyed waste of fine sand. Everywhere the rock underlies it, and there exists, of course, no possibility of utilising a space like this. But the whole of the central plateau—that is, of Nejd, Kaseem, Shomer, Yemamah, and the adjacent lands—is covered with a tolerably deep layer of calcareous earth, mixed with loam, well adapted for cultivation; the best is naturally to be found in the valleys and sheltered spots.

Whether, however, the soil be rich or poor, agriculture is, all over Arabia, very primitive in its conditions,

and, above all, in its implements. The plough used by the peasants is wholly of wood and without wheels, an instrument fit for scratching rather than furrowing the ground; while in many places the earth is merely turned over with a pitchfork, which is sometimes worked by two men at a time. More skill is shown in irrigation, for whatever crop is intended, its success cannot be safely entrusted to the uncertain rain supply alone. Accordingly, the slope of the ground, whether field or plantation, is carefully calculated, and the surface divided into compartments and traversed by furrows, each communicating with the other, and all with some large well, or, in favored situations, cistern; while in still more fortunate but rarer spots a running stream is turned to profit. But in far the greater number of instances the irrigation is from a well, with an orifice varying from six to twenty-five feet in diameter, whence the water is drawn up in large leather buckets, to which are attached ropes passing over pulleys, and worked by mules or oxen; these buckets, on reaching a cross-beam, turn over and empty their contents into a sloping trough that runs down to the main channel of the field or garden. Green crops, vegetables, and the like, are watered, when it is possible to do so, twice a day; date-palms only once: the porous soil soon absorbs any superfluous liquid that may have overpassed the bounds assigned to it. In ascertaining the right spot for sinking a well, in digging and coating it, as also in the construction of the small cisterns often connected with the source, the Arab peasants have by long practice acquired a not contemptible skill.

The crops most common in Arabia are, first, the date, a fruit already sufficiently described; it may, however, be remarked here that the fecundation of the female trees from the male is usually perfected by art. The produce is annual: the earliest dates ripen in May, others not till July or even August. This fruit, and the dishes made of it by pressure or with butter, are to the Arabs what corn is to more northern or rice to southern nations. Next in importance, though much more limited in extent, is coffee: very little, and that of inferior quality only, is cultivated out of Yemen. This growth has also been already described in detail. Next comes the following:—Wheat, a somewhat rare and not a very remunerative crop; barley, also in small quantity;—these two growths are hardly distinguishable the one from the other by the eye, the color and shape of the ear and beard being almost identical in each. Millet is, on the contrary, largely sown, and gives an abundant return; there are several species of it; the grain, coarsely ground, is made into a sort of gruel, which appears as a daily dish in Nejd. Rice is looked on as a delicacy: it does not grow in the central uplands, but succeeds well enough in the watered coast districts, especially Hasa, Kateef, and Oman. Beans and pulse are favorite crops; they are reared in almost every part of the peninsula. Other garden plants—melons, gourds, cucumbers, salad, cabbages, onions, garlic, parsley, cumin and the like,—are cultivated. Orchards are planted and tended in most districts; but of pruning the Arabs have little idea, though they are not unacquainted with grafting.

There being no true winter in any part of Arabia, the crops, such as they are, succeed each other all the year round; many lands bear twice, an early and a later harvest, though of different produce. Of manuring, of the scientific rotation of crops, of weeding even, and cleaning, the Arabs have little knowledge. Reaping is generally done with the sickle,—in some places the ripened grain is torn up by the hand; threshing is performed by oxen,—winnowing by the wind, grinding by the hand-mill. To sum up, though the agriculture of Arabia is

sufficient to supply its comparatively scanty population with food, it gives almost no surplus for traffic or exportation, that of coffee and dates alone excepted.

In pasture-land Arabia is, on the other hand, singularly fortunate. The very desert supplies, through the greater part of its extent, sufficient browse for camels; while the pasture-grass for horses, kine, and above all, for sheep, on the upper hill slopes, and especially in Nejd, is first-rate. The only draw-back is the occasional failure of the spring rains and autumn showers; when this occurs great distress is the result, and no commoner cause of contention and bloodshed arises between the Arab shepherds or "Bedouins" than the struggle to obtain, each for his own herd, the use of some yet undried well or exceptional oasis of green pasturage left fresh among the brown and withered herbage around.

In mineral products of a valuable description the Arabia of our days is singularly poor, so much so as to suggest the idea that the Arabian gold and jewels, often mentioned by classical writers, must have been brought from Yemen as from a mart or depot, not a place of production. Yet even so late as 600 A.D. the exiled monarch of Sanaa, Seyf of Yezen, could in his interview with the Persian despot Chosroes, describe southern Arabia as "a land the hills of which are of gold and its dust silver." Nowadays nothing is found to justify or even to account for such gorgeous statements. Agates, onyxes, carnelians, and, though rarely, topazes alone are to be met with; of gold mines and precious ores not a trace. Lead is, however, more common. The richest ore of this mineral comes from the mountains of Oman; it is brought down to Mascot, and exported thence by sea. A small quantity of silver is also extracted from the same mines. Cinnabar and iron occur in the Sinaïtic peninsula, and sulphur has been observed here and there in the long volcanic range that reaches from Palestine to Mecca. Rock-salt is extracted from many parts of the coast range; it exists, too, in the central districts of the peninsula, where of metals, a little iron excepted, not a vestige appears.

The Arab coasts are much frequented by fish, many of unknown species. Mackarel, mullet, sole, ray, and perch swarm in the Red Sea and Persian Gulf; nor are the sheltered spots on the long line that fronts the Indian Ocean less well provided. Sharks, too, abound along the coast, and are used as food by the poorer classes; crabs and oysters occur almost everywhere. Hence fishing forms the occupation of a large proportion among the literal population, but ignorance of salting and curing deprives its products of export value.

The pearl fisheries of Arabia alone add to the commercial riches of the country. They commence at the islands of Bahreyn, which lie immediately off the Arab shore, near the centre of the Persian Gulf, and continue east and south along the district of Katar for a distance of nearly 200 miles, after which the banks are lost in deep surroundings. The most productive shoals are those between the islands of Halool and the coast of Katar; the fishing season commences with the spring, and lasts all through the summer. Most of the villages along the coast are wholly inhabited by divers, Arabs and negroes, who by long practice can remain under water a space of two minutes at a time; the depth they reach does not exceed fifteen fathoms, and generally falls much short of it. The oysters are opened on shore, and the pearls carefully sorted and counted by officials stationed for the purpose, as a heavy duty, equalling 20 per cent. of their value, is levied on the spot, though no further dues are taken on exportation. Some of the pearls are of great size and value. The total annual produce is roughly estimated at about £250,000, but probably exceeds that sum; a portion goes to India;

another portion up the gulf to Baghdad, whence it is distributed over Syria, Turkey, and Persia. The divers themselves are the worst off, as their occupation induces various congestive diseases and premature old age.

Pearls are found, too, in other bivalve shells of these seas, and are extensively sold though at a lower price than those of the oysters. Mother-of-pearl is also common, and is an ordinary article of export, especially to Syria and Egypt; so are also occasionally the corals and ornamental shells with which these seas abound.

In mechanical arts the Arabs are, as a rule, extremely deficient, though favorable exceptions exist in some districts. The Bedouin or pastoral population know little else than the tanning of leather and the weaving of coarse fabrics, such as articles of overdress, tent coverings (which the women generally make of goat-hair), headbands, and the like. In most villages and towns of Nejd, one or more blacksmiths, whose work is of the rudest possible description, are to be found; occasionally an armorer, a few sandal-makers and workers in leather, with several weavers,—none skilled. Throughout the Hejaz these professions exist, but at a still lower standard; but in Yemen greater nicety of workmanship is to be met with; and gold and silver smiths, often, however, not Arabs, but strangers by race, get a living in the towns. Formerly Yemen was celebrated for its woven stuffs; this manufacture is now, however, in anything approaching to excellence, the exclusive pride of Oman. In this last-named province, weaving, silk and gold thread embroidery, silver work, gold filigree, and even steel implements, are wrought to a degree of perfection seldom attained by the workmen even of Damascus or Baghdad; and the labors of the Oman loom or forge, when exported, as they are, though not in large quantities, are eagerly purchased abroad. But even here the extreme simplicity, or rather rudeness, of the tools employed, and the deficiency of mechanical contrivance, dwarf the results of patient and otherwise ingenious labor into comparative insignificance.

In wood the Arabs are not unskilful artificers; and their drinking-bowls and platters, manufactured chiefly from the "ithel" or larch tree, and studded with small silver knobs, make a good appearance. As masons they deserve little praise; their constructions are clumsy and unstable, the details coarse and ill-fashioned. There is not a single building, public or private, built by the Arabs themselves, of any merit either in regard of utility or of beauty, within the whole of Arabia.

Backward in manufacture, and even showing, on the whole, little capacity for it, the Arabs are singularly alive to the advantages of commerce and trade, and fond of exercising them. No Arab undertakes a journey, were it only from one village to another, without taking with him some object for exchange or sale; and he will sooner chaffer away the handkerchief on his head or the camel on which he rides, than return without having effected something in the way of business. In this respect, Bedouin and townsman, rich and poor, are all alike; and their history shows that this propensity is no less ancient than universal in the race. Owing, however, to the want of variety in its productions, and the remarkably uniform habits of its inhabitants, combined with the scarcity of local manufactures, the trade of Arabia, whether export or import, is soon catalogued. Camels and sheep, hair and wool, come first on the export list; next coffee; then dates, then horses; a very little rice and a few cloaks from Yemen or Oman close the chapter of commerce so far as land produce is concerned; pearls sum up that of the sea. Nor is the import much more diversified or extensive. Cotton cloth, Indian prints, sugar, a little hardware, a few arms, powder and shot, and trinkets of no great value—such

are the customary requisitions of the land. Nor has any single Arab, the Imam or Prince of Mascat alone excepted, sufficient available capital for extensive traffic, out or in; while the Mahometan prohibition of interest, and consequently of credit, joined to the illegality of insurance, would, even in a richer land, restrict enterprise within very unsatisfactory bounds. It is owing, indeed, to these narrow-minded laws, introduced by the Koran and co-existent with its observance, that what commerce exists at the seaports of Hejaz, Tehamah, and Yemen, has mainly fallen into the hands of Jews and Banians—that is, Indian merchants; though in Oman, where a more liberal spirit prevails, Arab merchants of considerable capital and with extensive connections are to be found. The custom-duties in the ports of Oman and the Persian Gulf, whether export or import, are 10 per cent. except on pearls; in the harbors of Yemen they are capricious, and often very high. The shereef or governor of Mecca used formerly to carry on, through Jiddah, a trade hardly inferior to that of the Imam of Mascat himself; but the devastations committed by the Wahhabees, and in later times the oppression of the Egyptian and Turkish governments, have considerably reduced this source of Arab income.

The origin of the Arab race, like that of most others can only be matter of conjecture; no credit can be attached to the assertions, evidently unbased on historical facts, of those authors who, building on the narrow foundation of Hebrew records, have included the entire nation under the titles of Ishmael and Joktan; and Mahometan testimony on these matters can have no more weight than the Jewish, from which it is evidently derived.

Once established on the same soil, the two branches would naturally early manifest a tendency to unite, sufficient in time to produce a tolerable identity both of language and usages: while the superinduced modifications of character and manners may well have originated the rivalry and even enmity between the Arabs of the north, or "Keysees," and those of Yemen, which, under various forms, has never ceased down to our own time.

At present, however, the most important, as also the best known division of the Arab race is that which separates them into "Ahl Bedoo," or "dwellers in the open land," whence the common appellation of Bedouin; and "Ahl Hadr," or "dwellers in fixed localities." The former class, living under tents, and occupying the waste country which lies in a vast circle between the coast and the central plateau, while to the north it joins on to the Syrian desert, are the best known to European travellers, with whom they often come in contact, and by whom they have sometimes been described with considerable exaggeration both as to their numbers and in other respects. The most trustworthy authorities regarding them are Niebuhr and Burckhardt.

The Bedouins, then, are shepherds and herdsmen, reduced to an out-of-doors and roving life, partly by the intrinsic nature of their occupations, partly by the special characteristics of the country they belong to. For, while land, unsuited to all purposes except pasture, forms an unusually large proportion of the surface in the Arabian territory, the prolonged drought of summer renders considerable portions of it unfit even for that, and thus continually obliges the herdsmen to migrate from one spot to another in search of sufficient herbage and water for their beasts. The same causes also involve the Bedouins in frequent quarrels with each other regarding the use of some particular well or pasture-ground, besides reducing them not unfrequently

to extreme want, and thus making them plunderers of others in self-support. Lastly, the loneliness of the desert, far removed from the vigilant control of fixed law, order, or police, has, combined with the other circumstances, continued during generation after generation to leave a peculiar impress on a naturally bold, hardy, and enterprising race, till the terms Bedouin and brigand have, in the opinion of many, become synonymous.

This opinion is, however, unjust. Professionally, and in the ordinary course of their lives, Bedouins are only shepherds and herdsmen: their raids on each other, or their exploits in despoiling travellers and caravans, are but occasional, though welcome and even exciting, exceptions to the common routine. Besides, their wars or forays among themselves,—for they very rarely venture on a conflict with the better armed and better organised sedentary population,—are rarely bloody; the object being most often with the one party to carry off, and with the other to protect, a flock of sheep or a herd of camels: booty is aimed at, not slaughter.

Instances are, however, not wanting in Arab history of fiercer and more general Bedouin conflicts, in which the destruction, or at least the complete subjugation, of one tribe has been aimed at by another, and when great slaughter has accordingly taken place. Such were the wars of Pekr and Thagleb in the 6th century, of Kelb and Howazin in the 8th, of Harb and Oteybah in the 18th, with others. But these are comparatively rare events.

The Bedouins regard the plundering of caravans or travellers, whether on business or otherwise, simply as a supplementary measure that takes the place of passports or custom dues exacted elsewhere. The land is theirs, they say, and trespassers on it without leave must pay the forfeit.

Nominally Mahometan, most of the Bedouins pay slight attention to the ceremonial precepts of the Koran; among the remoter and wilder tribes sun-worship, tree-worship, and no worship at all, are not uncommon. Some clans even omit the rite of circumcision altogether; others, like the tribe of Hodeyl, south of Mecca, perform it after a fashion peculiar to themselves. Nor are the social and moral injunctions of Islam better observed. Marriages are contracted without any legal intervention or guarantee; the consent of the parties, and the oral testimony of a couple of witnesses, should such be at hand, are all that are required; and divorce is equally facile. Nor is mutual constancy much expected or observed either by men or women; and the husband is rarely strict in exacting from the wife a fidelity that he himself has no idea of observing.

In person most Bedouins, men or women, are rather undersized, the result probably of hardships endured through uncounted generations; their complexion, especially in the south, is dark: their hair coarse, copious and black; their eyes dark and oval; the nose is commonly aquiline, and the features well formed; beard and moustache are apt to be somewhat scanty. The men are active, but not strong; the women rarely otherwise than plain.

Their dress is simple enough; that of the men consisting in a long cotton shirt, open at the breast, and often girt with a leathern girdle; a black or striped cloak of hair is sometimes thrown over the shoulders; a handkerchief, folded but once, and generally black, more seldom striped yellow and red, covers the head, round which it is kept in its place by a piece of twine or a twisted hairband. To this costume a pair of open sandals is sometimes added. No other article of dress is worn,—neither trousers nor turban; but under the

shirt, round the naked waist, a thin strip of leather plait is wound several times, not for any special object, but merely out of custom. In his hand a Bedouin almost always carries a slight crooked wand, commonly of almond-wood; with this he guides his camel when on the road, and amuses himself by playing with it at other times. Among the Bedouins of the south a light wrapper takes the place of the handkerchief on the head, and a loin-cloth that of the shirt.

A woman's attire is hardly more complicated; wide loose drawers, though these are sometimes dispensed with; next a long shirt, and over it a wide piece of dark blue cloth enveloping the whole figure, the head included, and trailing on the ground behind. Boys, till near puberty, usually go stark naked; girls up to six or seven.

On a journey a Bedouin invariably bears with him a light sharp-pointed lance, the stem of which is made Persian or African cane; the manner in which this is carried or trailed often indicates the tribe of the owner. The lance is the favorite and characteristic weapon of the Arab nomade, and the one in the use of which he shows the greatest skill, throwing it, at need, to a considerable distance with unerring aim. Frequently, too, he girds on, or rather suspends from a kind of shoulder-belt, a sword, straight or crooked as may be; the blade is often of little value, rusty, and not over sharp; the scabbard of wood. The weapon which comes third in frequency is a gun; this is still in almost every instance a matchlock, clumsy and foul, taking from five to ten minutes to load and fire, when, indeed, it can be fired at all, which is not always the case. Yet with such wretched implements at his disposal, a Bedouin is seldom other than a good marksman. Flint-guns may here and there be met with now-a-days; but percussion or breach-loaders never. Nor are pistols any part of a Bedouin's war equipment. But whether in peace or war, he is seldom without a knife: this in the north is only a large clumsy clasp or sheath knife; but in Yemen, Oman, and the intervening regions it develops into a broad and crooked dagger, a truly formidable weapon, on the ornamentation of which the Bedouin of the south bestows what skill or wealth he may happen to possess.

From the Bedouins, or "Ahl Bedoo," we now turn to the "Ahl Hadr," or the dwellers in fixed abodes. These constitute about six-sevenths of the population of Arabia proper, and it is from them alone a just appreciation of the Arab character and customs can be formed.

Though the clan and the family form the basis and are the ultimate expression of the civilised Arab society, they do not, as is the case among the Bedouins, sum it up altogether; local feelings and duties, the consequences of settled life, having deeply modified the character alike of the individuals and the race among all Arabs, town or country. Still, blood is the first thing taken into account; and, indeed, the possession of written records, and habits of order and reflection, enabled the settled Arabs to acquire and retain a more accurate knowledge and nicer distinction of pedigree and race than could be expected or found among the unreflecting and half-barbarous Bedouins.

Throughout the peninsula, but especially on the western side, the family of Koreysh is even yet regarded as the noblest of Arab races; indeed of the world; and its members, on the strength of their connection with the Prophet, all bear the title of "Shereef," sometimes also, as in Yemen, that of "Seyyid," or "lord." Besides the advantages which naturally follow popular respect, they hold in several districts of Arabia—in Mecca itself, for example, in Aboo-Areesh, and in some parts of Yemen

— the positions and emoluments of local hereditary governors. But they do not assume any regular distinctive mark, like the green turban so often worn in Turkey or Persia; nor in private life do they enjoy any immunity, either explicit or prescriptive, from the ordinary obligations of law.

"Sheykh," or elder, "Emeer," or ruler, "Imam," or precursor, and "Sultan," or monarch, are personal and often, though not necessarily, hereditary titles of rank.

Emeer is a higher title, restricted to a governor of a district or province, especially in Shomer, Nejd, and the rest of the central region. An ameer is in most respects nothing but a magnified sheykh; he has, however, the advantage of drawing a considerable portion of his income from the country he administers.

The title of "sultan," or king, one of doubtful antiquity, has been assumed by the hereditary Wahhabee ruler of Riad, the capital of Nejd; it is often also applied to the sovereign of Oman, and to some petty princes in the south of the peninsula. In practice it adds little or nothing to the dignity of emeer, but implies a larger territorial range of authority.

Where the Wahhabee doctrines have definitely established themselves, as in Nejd, Yemameh, Hareek, Aflaj, and Jabel Aseer, the Mahometan code, as laid down in the Koran, is observed more strictly perhaps than in any other part of the Eastern World. Besides the principal mosque, or "jamiá," for Friday prayers, indispensable in every town or village, smaller praying-places, or mesjids, are erected in every quarter. These buildings are mere oblong rooms, flat-roofed, supported on numerous rough pillars placed close to each other, and with no architectural or decorative beauty whatever; but are kept scrupulously clean, and laid down partly with mats, partly gravel. In most cases there is no minaret attached, the times of prayer being merely announced by the "mueddin," or crier, from the roof itself.

Except in a few places on the west coast long exposed to Egyptian, Turkish, and Indian influences, no dervishes are to be met with, or are even tolerated, in Arabia proper. The Wahhabees all hold them in the utmost contempt and abhorrence. Nor are Arabs, generally speaking, superstitious in other respects: of dæmons and omens they make little account; nor does the apprehension of ghosts, spectres apparitions, demons, and the like often disquiet their hours of loneliness or darkness; stories of such a character, though embodied here and there in Arab literature, in the *Thousand and One Nights* for example, are less frequently of Arab than of foreign origin, generally Persian. Nor do Arabs often seek to convert others, except it be their own purchased negro slaves, a facile acquisition, to Mahometanism, or molest those of other religions. Jews exist undisturbed in great numbers near Teyma and in the south; Hindoos worship cows and burn their dead without interference in Oman; only old custom, it would seem, and the memory of long and bitter wars, prohibits the practice of the Christian religion in Arabia proper,—Aden alone, of course, where the British flag proclaims absolute tolerance, excepted.

Slavery is still, as of old times, a recognized institution throughout Arabia; and an active traffic in blacks is carried on along the coasts of the Persian Gulf and the Red Sea, but especially the former.

The slaves themselves are chiefly brought from the east African coast districts down as far as Zanzibar, and from the Galla tribes in the interior; a few Abyssinians, too, are sometimes imported. Slaves are usually employed in Arabia as herdsmen or as domestic servants, rarely in agricultural works; they also form a considerable portion of the bodyguards with which Eastern greatnes loves to

surround itself. Like their countrymen elsewhere, they readily embrace the religion of their masters, and become zealous Mahometans, though rarely according to knowledge. Arab custom enfranchises a slave who has accepted Islam at the end of seven years of bondage; and when that period has arrived, the master, instead of exacting from his slave the price of freedom, generally, on giving him his liberty, adds the requisite means for supporting himself and a family in comfort. Further, on every important occasion, such as a birth, circumcision, a marriage, or a death, one or more of the household slaves are sure of acquiring their freedom. Hence it comes that Arabia is densely sprinkled with a free black population; and these again by intermarriage with the whites around, have filled the land with a mulatto breed of every shade, till, in the eastern and southern provinces especially, a white skin is almost an exception. This has taken place all the more readily that in Arabia there exists no prejudice against negro alliances; no social or political line separates the African from the Arab. A negro may become a sheykh, a kadee, an emeer, or whatever his industry and his talents may render him capable of being. This occurs frequently, particularly in Nejd, Yemen, and Hadramaut; in the Hejaz and the north, on the contrary, a faint line of demarcation may be observed between the races.

An Arab town, or even village, except it be the merest hamlet, is invariably walled round; but the ramparts are low, and seldom of any stronger material than dried earth; they are occasionally flanked by towers of like construction, such as befit a country where cannon are unknown and fire-arms are yet at the matchlock stage. A dry ditch often surrounds the whole. The streets are utterly irregular—some broad, some narrow, all tortuous; the houses are of one or two storeys, very rarely of three, with flat mud roofs, little windows, and no external ornament. If the town be large, the expansion of one or two streets becomes a market-place, where are ranged a few shops of eatables, drugs, coffee, and, very rarely, cottons or other goods. Many of these shops are kept by women. The chief mosque is always near the market-place; so is also the governor's residence, which, except in size and being more or less fortified Arab fashion, does not differ from a private house. Drainage is unthought of; but the extreme dryness of the air obviates the inconvenience and disease that under other skies could not fail to ensue, and which in the damper climates of the coast make themselves seriously felt. But the streets are roughly swept every day, each householder taking care of what lies before his own door. Whitewash and color are occasionally used in Yemen, Hejaz, and Oman; elsewhere a light ochre tint, the color of the sun-dried bricks, predominates in an Arab town or village, which looks at a distance like a large dust-heap in the centre of the bright green ring of gardens and palm-groves all around. Baked bricks are unknown in Arabia, and stone buildings are rare, especially in Nejd. Palm branches and the like, woven in wattles, form the dwellings of the poorer classes in the southern districts. Many Arab towns possess watch-towers, like huge round factory chimneys in appearance, built of sun-dried bricks, and varying in height from 50 to 100 feet, or even more. Indeed, two of these constructions at the town of Birket-el-Mawj, in Oman, are said to be each of 170 feet in height, and that of Nezwah, in the same province, is reckoned at 140; but these are of stone. Some of these watch-towers are so built as to serve also for citadels or places of refuge; and none could offer a minute's resistance to any kind of artillery, though formidable obstacles to men whose only means of attack are lances and matchlocks.

The principal feature in the interior of an Arab house is the "kahwah," or coffee-room, as from its destination it is commonly called. It is a large apartment spread with mats, and sometimes furnished with carpets and a few cushions. At one extremity is a small furnace or fire-place, for preparing coffee. In this room the men congregate; here guests are received, and even lodged; women rarely enter it, except at times when strangers are unlikely to be present. Some of these apartments are very spacious, and supported by pillars; one wall is usually built transversely to the compass direction of the kaabah; it serves to facilitate the performance of prayer by those who may happen to be in the kahwah at the appointed times. The other rooms are ordinarily small, and appropriated to the use of the females of the family and to domestic life.

In hospitality the Arabs of our time have in no degree degenerated from their former reputation, though Shomer, Nejd, Yemamah, and Hasa excel in this respect the other provinces. A stranger's arrival is often the occasion of an amicable dispute among the wealthier inhabitants as to who shall have the privilege of receiving him; and though three days are often popularly spoken of as the limit of such entertainment, practice sets no precise bounds to its length; and an Arab host always carefully abstains from putting any question to his guest as to when he is going, or where. Indeed, if the guest be discreet and acceptable in his manners, he will soon find himself on the footing of one of the family; and even the women of the house will come in to sit and converse with him not less freely than they would with their own relations.

Arab cookery is of the simplest. Roughly-ground wheat cooked with butter; bread, in thin cakes, prepared on a heated iron plate or against the walls of an open oven; a few vegetables, generally of the leguminous kinds; boiled mutton or camel's flesh, if the circumstances of the host allow of such luxuries; dates and fruits,—this is the *menu* of an ordinary meal. Roast meat, fried, stewed—in a word, anything but boiled—is rarely seen, such dishes exceeding the skill of the cooks, who, as a rule, are the women of the household. Rice is eaten in wealthy houses, and fish is common on the coasts. Among the Bedouins, millet-cakes, half-cooked in ashes, or a broth prepared from the gritty seeds of the "samh" (a species of *Mesembryanthemum*), often take the place of bread; and their meat cookery is equally wretched. Game, such as venison, partridge, and hare, is served up on rare occasions. Camel meat is a favorite, but to a stranger a very insipid dish, in southern Nejd, Yemamah, Hareek, and Affaj. Spices are freely employed in town cookery; butter much too largely for a European taste.

After eating, the hands are always washed with soap, or some substitute for it, commonly the ashes of an alkaline plant. A covered censer with burning incense is then passed around, and each guest perfumes his hands, face, and sometimes his clothes; this censer serves also on first receptions, and whenever special honor is intended. In Yemen and Oman scented water often does duty for it. Coffee, without milk or sugar, but flavored with an aromatic seed brought from India, is served to all. The wealthier townsmen prefer long pipes with large open bowls; but the most frequent use is made of the water-pipe, or "narghileh," of which implement every form, kind, and dimension imaginable may be found in Arabia. The tobacco smoked is generally strong, and is either brought from the neighborhood of Baghdad or grown in the country itself. The strongest quality is that of Oman; the leaf is broad and coarse, and retains its green color even when dried; a few whiffs have been known to produce abso-

lute stupor. The aversion of the Wahhabees to tobacco is well known; they entitle it "mukhzee," or "the shameful," and its use is punished with blows, as the public use of wine would be elsewhere.

In dress much variety prevails. The loose cotton drawers, girded at the waist, which in hot climates do duty for trousers, are not often worn, even by the upper classes, in Nejd or Yemamah, where a kind of silk dressing-gown is thrown over the long shirt; frequently, too, a brown or black cloak distinguishes the wealthier citizen; his head-dress is in its character the same as that of the Bedouins—namely, a handkerchief fastened around the head by a band—only of better materials. But in Hejaz, Yemen, and Oman, turbans are by no means uncommon; the ordinary color is white; they are worn over one or more skull-caps—sometimes fifteen—till the head is rather burdened than protected. Trousers also form part of the dress in the two former of these districts; and a voluminous sash, in which a dagger or an inkstand is stuck, is wrapped round the waist.

In person the Arabs are a remarkably handsome race,—tall, lithe, well-formed, dark-eyed, and dark-haired. Deformed individuals or dwarfs are rare among them; nor, except leprosy, of which frequent instances may be met with throughout the peninsula, does any disease seem to be hereditary among them. The frequency of ophthalmia, though not in the virulent Egyptian form, is evidently attributable to the nature of the soil and climate. They are scrupulously clean in their persons, adding to the prescribed ablutions of the Mahometan code frequent supererogatory washings of their own; and take special care of their teeth, which are generally fine, though toothache is by no means unknown in Arabia. Simple and abstemious in their habits, they often reach an extreme yet healthy old age; nor is it common among them for the faculties of the mind to give way sooner than those of the body. To sum up, physically and morally they yield to few races, if any, of mankind; mentally, they surpass most, and are only kept back in the march of common progress by the remarkable defect of organising power and incapacity for combined action which they share with many other nations of the East, and some, it would seem, of the West also.

Of the revenues of Arabia it would be difficult to form anything like a correct estimate. Palgrave has stated the yearly receipts of the Nejdian treasury, inclusive of the tribute then (1862) paid into it by Bahrein and the west of Oman, to be nearly £106,000 sterling—no very large sum.

The revenues of Oman itself, then in a comparatively prosperous condition, are estimated by the same author at nearly ten times the amount, but may possibly have been overrated by him, as those of Yemen were perhaps by Niebuhr. Certainly the general condition of these provinces—the restricted character of the cultivation and the evident poverty (not absolute want, indeed, for that is rare) of the greater number of the inhabitants—do not convey to the visitor the idea of large national wealth or extensive resources. There can, however, be no doubt that both the coast districts of Arabia, in their varied and valuable products, and the central plateau, with its palm-groves, well irrigation, and wide pasture-lands, might, under a judicious administration, become the sources of much greater revenues, both public and private, than is now the case. The mines, too, in the metamorphic districts of Yemen and Oman, remain yet to be properly worked. As for the desert proper, which, as we have seen, occupies about one-third of the peninsula, it must, like the ocean of *Childe Harold*, remain what it is to the end of time.

In the 7th century Arabia sent forth armies that attacked and conquered nearly half the then known world. But the secret of her conquests lay not in the number of her warriors, but in a resolute purpose, a unity of aim, and an enthusiasm which concentrated in itself and intensified every motive of human action. In later ages she has been reduced to the defensive, and has shown herself not always equal even to that: witness her conquest by the Turks in the 16th, and by the Egyptians in the present century. Once only, at the moment when Wahabee union and zeal half restored for a few years the energy of early Islam, did her armies go forth to invade the neighboring territories of Mesopotamia and Syria; but it was to plunder rather than to conquer, and the results lasted no longer than the invasions themselves.

Yet on the defensive Arabia had much in her favor, and that from many causes. The first is, that there is little to defend, since, the coast of Yemen and the districts of Bahrein and Oman excepted, there is very little to excite the cupidity of an invading, and nothing to satisfy the exigencies of an occupying force. The second is, that the mountainous nature of Yemen and Oman themselves, and the narrowness of their labyrinthine defiles added to the extreme heat of the climate, and the scarcity of available provisions, would make even those provinces hard to attack, harder to retain. A third cause is in the broad strips of desert that gird the central districts as with a moat of sand, and send long arms of barrenness here and there into the heart of the cultivated or pastoral regions, so as to render military operations on a large scale in the interior almost impossible. A fourth and a very serious obstacle to invasion is the character of the inhabitants. Personal courage, wonderful endurance of privation, fixity of purpose, and a contempt of death rare even in the bravest Europeans, are qualities common to almost every race, tribe, and clan that compose the Arab nation; and though their undisciplined troops are unfitted to meet a better trained enemy in a regular battle, in skirmishing and harassing they have few equals, while at close quarters their individual impetuosity often disconcerts the more mechanical fortitude of organized regiments. To this English troops gave testimony in the engagements of Shenaz, 1810, and of Ras-el-Hadd, 1819 and 1820, when, with swords and spears alone, the Arabs of Oman maintained a desperate struggle against guns and bayonets, neither giving nor receiving quarter. Nor are they wholly ignorant of tactics, their armies, when engaged in regular war, being divided into centre and wings, with skirmishers in front, and a reserve behind, often screened at the outset of the engagement by the camels of the expedition. These animals, kneeling, and ranged in long parallel rows, form a sort of entrenchment, from behind which the soldiers of the main body fire their matchlocks, while the front divisions, opening out, act on either flank of the enemy. This arrangement of troops may be traced in Arab records as far back as the 5th century, and has often been exemplified during the Wahabee wars in our own day.

The military contingent of Nejd, including that of all the adjoining provinces that constitute central Arabia, Jebel Shomer excepted, is reckoned by Palgrave at 47,300 from among the settled, and at about 8000 from among the nomade inhabitants. That of Shomer is estimated by the same authority at 14,000 of the first, and at about 16,000 of the second category. Oman, including the neighboring and allied districts, is said to supply about 112,000, all from towns or villages.

We thus obtain a total of about 197,300 fighting men for what represents a full half of the Arab peninsula. If, therefore, we calculate the entire military force of

the land from Suez to Aden, and from the Red Sea to the Indian Ocean, at 400,000 fighting men, we shall probably be not far from the truth. But while remembering, on the one hand, that this is no standing army, nor composed of regular and disciplined soldiers, it should not be forgotten that, in case of invasion, their energy, and, it may be, their numbers, would be doubled by the enthusiasm of patriotism; and that not every male only, but every woman would, in the excitement of the struggle, take part in the national defence.

Indeed, at all times Arab women have distinguished themselves by their bravery hardly less than Arab men. Records of armed heroines occur frequently in the chronicles or myths of the pre-Islamic time; and in authentic history the Battle of the Camel, 656 A.D., where Ayesha, the wife of Mahomet, headed the charge, is only the first of a number of instances in which Arab amazons have taken, sword in hand, no inconsiderable share in the wars and victories of Islam. Even now it is the custom for an Arab force to be always accompanied by some courageous maiden, who, mounted on a blackened camel, leads the onslaught, singing verses of encouragement for her own, of insult for the opposing tribe. Round her litter the fiercest of the battle rages, and her capture or death is the signal of utter rout; it is hers also to head the triumph after the victory of her clan.

There is little education, in our sense of the word, in Arabia. Among the Bedouins there are, of course, no schools, and few, even of the most elementary character, in the towns or villages. Where they exist, little beyond the mechanical reading of the Koran, and the equally mechanical learning of it by rote, is taught. On the other hand, Arab male children, brought up from early years among the grown-up men of the house or tent, learn more from their own parents and at home than is common in other countries; reading and writing are in most instances thus acquired, or rather transmitted; besides such general principles of grammar and eloquence, often of poetry and history, as the elders themselves may be able to impart. To this family schooling too are due the good manners, politeness, and self-restraint that early distinguish Arab children. In the very few instances where a public school of a higher class exists, writing, grammar, and rhetoric sum up its teachings. Law and theology, in the narrow sense that both these words have in the Islamic system, are explained in afternoon lectures given in most mosques; and some verses of the Koran, with one of the accepted commentaries, that of El-Beidawee for example, form the basis of the instruction.

Great attention is paid to accuracy of grammar and purity of diction throughout Arabia; yet something of a dialectic difference may be observed in the various districts. The purest Arabic, that which is as nearly as possible identical in the choice of words and in its inflections with the language of the Koran, is spoken in Nejd, and the best again of that in the province of Sedeyr. Next in purity comes the Arabic of Shomer. Throughout the Hejaz in general, the language, though extremely elegant, is not equally correct; in Hasa, Bahrein, and Oman, it is decidedly influenced by the foreign element called Nabathæan, that removes it still further from its original character. In Yemen, as in other southern districts of the peninsula, Arabic merges by insensible degrees into the Himyaritic or African dialect of Hadramaut and Mahrah. The Arabic spoken by the nomade or Bedouin tribes, especially those of the north, is tolerably correct, but the pronunciation is often inexact.

The entire population of Arabia proper has been variously estimated; some authors make it reach 12,000,000,

others reduce it to 7,000,000. Taking the approximate statistics above given, we find for the whole of central Arabia, including Jowf, Shomer, and Nejd, about 1,500,000 settled inhabitants, with 500,000 Bedouins or nomades; thus 2,000,000 may perhaps fairly represent the complete number. The east coast—Hasa, Bahreyn, Oman, and their adjoining districts—furnishes 2,500,000 more. Yemen is said to contain about 1,000,000: Hadramaut and Mahrah cannot be very populous: the Hedjas certainly is not. 3,000,000 is the maximum estimate of both taken together, nomades or villagers. To these must be added the tribes of the Sinaitic peninsula, and of the northern frontier. These may possibly bring the sum of the Arab population to 8,500,000, or even 9,000,000, with a quota of about one-fifth Bedouin to four-fifths of settled Arabs; to such small numerical proportions has the nation shrunk that once ruled by land and sea from the Indus to the Atlantic. To-day the approximate population of Hedjaz and Yemen is a little over a million.

Arabia proper is singularly destitute of antiquities, in the ordinary sense of the word, the northern or "Adscititious" Arabs having been, so long as they remained in their own territory, a remarkably unconstructive race, and the "pure" or southern Arabs not much better in this respect.

It is true that in addition to the non-constructive character of the early Arab race, account must be taken of the destructive policy, aggravated by iconoclastic zeal, pursued by the conquering Mahometan tribes of the north, who within their own territory, even more than in the acquired lands of Egypt, North Africa, and elsewhere, carried out the plan of establishing their own religion and system, not merely on the ruins, but, so far as possible, on the effacement of whatever had preceded it. Hence, of the old idol temples which once covered Arabia, nothing now remains except the megalithic vestiges of an enormous stone circle, resembling those found in some parts of Europe, and consisting of large boulders, each about 14 feet high, placed on end, and originally crowned by a similar horizontal series. This was visited by Palgrave when travelling in the province of Kaseem, near Bereydhah; two others are reported to exist in the same district. Nor, the Meccan relics apart, had any of the numerous idols once worshipped throughout the peninsula been discovered till the Swiss Munzinger, some years since, found among the heaps of a deserted village near Aden a small bronze statue representing a naked hermaphrodite figure, over the head of which rises an ornament resembling the Egyptian *pschent*.

But if poor in architectural, Arabia is superabundantly rich in literary monuments. Passing over as of more than doubtful authenticity the verses ascribed to kings and heroes of Yemen, especially at dates of a thousand years or more before the Christian era, we find undeniable specimens, at least two full centuries before Mahomet, of poems which in vigor and polish yield to few ever composed in the Arab or any other language. To give at length the names and stories of the authors, many of them men, and even women, no less distinguished in their day by the sword than by the pen, would be, in a brief review like this, merely to note a dry and unmeaning catalogue. Suffice it that, even at this early date, we find the metrical and rhythmical laws, simple yet susceptible of the highest art, which have ever since regulated Arab poetry, already laid down in their completeness, and exemplified, the former by a scansion of almost Horatian elegance and variety, the latter by a severe nicety that Pope himself might have admired, but could hardly have imitated. Divided into sixteen classes, each class including several variations, the metres are based, like the Greek and Roman, on long and

short vowels, irrespective of accent, but admitting cæsure, elision, and every prosodial delicacy. Some are adapted to gay, some to serious topics, love, war, description, moral precepts, philosophical speculation, elegy, satire—all find here their appropriate expression. The rhyme, which often involves not one but two syllables, is in every piece determined by that of the opening line. Alternate rhymes, choruses, and accentuated instead of quantitative metre, did not appear till later, and were imitated from extra-Arab models.

Written prose up to the date of Mahomet's appearance there was absolutely none; and spoken eloquence, though always highly esteemed and diligently cultivated among the Arabs, had never been embodied in the permanence of writing.

But if unsuccessful in prose, the Arabs were not so in poetry. This, even before the era of the prophet, had, as we have seen, attained no ordinary degree of excellence; and it reached its highest point during the following century, under the Ommiad dynasty, when Omar Ebn Rabceyah, of the tribe of Koreysh; Jameel, of the Benoo Adhras; Jareer and Farzadak, both of Tameem; and Noseyyeb, a negro by birth—the first and second masters of erotic, the third and fourth of satirical, and the fifth of descriptive poetry—with a cloud of lesser celebrities, lived and sang in the sunshine of the Damascene court. The 8th and 9th centuries, agitated by civil dissensions or oppressed by the tyranny of the Abbases, were less favorable to the Muses, till the reaction of the Greek and Persian minds, with which the Arab spirit was now yearly brought into more intimate contact, gave rise to a new and brilliant school, less true to the simplicity of nature or the purity of Arab diction, but richer in imagery and deeper in philosophic thought, illustrating, too, the transition from the objective to the subjective which has accompanied and half veiled decline in the literature of every nation, turn after turn.

History proved from first to last an effort beyond Arab skill, which contented itself with the less intellectual task of multiplying chronicles to an almost unparalleled amount.

In mathematics the Arabs based themselves on what they had acquired from the Greek and Indian originals; the former gave them geometry, the latter algebra. Satisfied at first with translations of Euclid, Apollonius, and others, they ultimately left their masters behind. They reached in the 10th century the limits of spherical trigonometry, and solved quadratic and even cubic equations. In these studies the astronomers Geber and Ebn-Moosa chiefly distinguished themselves. Optics, too, and hydrostatics were investigated by the professors of Baghdad; but no special progress or remarkable discoveries are recorded as having been made in these sciences. In mixed as well as in pure mathematics the leading-strings of the Greek became the fetters of the Arab mind. The practical application, however, of hydraulics in the construction of wells, water-works, reservoirs, sluices, canals, and the like, does them great credit; and of this peculiar skill ample traces, ill maintained by succeeding governments, remain in Spain, North Africa, Egypt, Syria, and Mesopotamia.

Debarred by religious scruples from the representation of animated forms in sculpture or painting, Arab decorators (for they are no more) found themselves restricted to vegetables or fantastic patterns and color combinations, and in these, as the Spanish Alhambra and other buildings can testify, showed themselves no mean proficient.

More mildly recognized, however, are the Arab claims to proficiency in medicine, an art which Mahomet himself appears to have dabbled in, showing himself, if

tradition speaks true, by no means so good a physician as he was a preacher. Under the caliphs, however, regular schools of the therapeutic science were established in Damascus, Baghdad, and Cairo, where the works of Hippocrates and Galen, translated from their originals in Greek, were adopted as the basis of instruction.

Botany was chiefly studied as subsidiary to medicine; nor did chemistry ever attain the dignity of a separate science; as, however, an adjunct to the old herbal pharmacopœia, it received close and not unsuccessful attention. The principal mercurial and arsenical preparations of the *materia medica*, the sulphates of several metals, the properties of acids and alkalies, the distillation of alcohol,—in fine, whatever resources chemistry availed itself of up to very recent date—were, with their practical application, known to Er-Razi and Geber, already mentioned. In fact, the numerous terms borrowed from the Arabic language—alcohol, for instance, alkali, alembic, and others—with the signs of drugs and the like, still in use among modern apothecaries, have remained to show how deeply this science is indebted to Arab research.

Industrious and enterprising, the Arabs led the way by their invention and skill to most of the more complicated manufactures of our own times. In metallurgy, their art in tempering and enamelling has become justly famous; nor did any sword-blades ever rank higher than those of Damascus, nor any coppersmiths excel those of Baghdad, or gold and silver workmanship that of Oman.

ARABIAN NIGHTS ("A thousand nights and one night"), the best-known and most popular product of Arabian literature. Its origin is lost in tradition, but it is mentioned by an Arab writer of the tenth century as being well known, having been translated from the Persian long before. The introductory chapters tell how a Persian king who had been deceived by his wife put her to death, and thereafter married a new wife every day and had her killed in the morning. Finally a daughter of his grand vizier named Scheherazade importuned her father to marry her to the king, as she had a plan for stopping this wholesale slaughter. The marriage occurred, the bride begged of the king to permit her sister to remain in the bridal chamber, and there she began a story which she broke off at an interesting point, promising to renew the tale next evening. The king spared her life for the time, and thus for a thousand and one nights she continued to pour forth tales of adventure until the monarch repented, and, as the story-books say, they lived happily ever after.

The stories range over a wide field and treat of genii and fairies, of afrites, ghouls, young princes shut up in brazen towers and beautiful princesses stolen away by wicked magicians. Every school-boy knows or should know the story of Aladdin and the wonderful lamp and the adventures of the great Caliph, Haroun-al-Raschid. An English translation was published by Lane in 1840 and in 1885 Sir Richard BURTON (*q.v.*) issued a limited number of an edition of ten volumes of a vigorous and literal translation from the Arabic.

ARABIAN PHILOSOPHY owed to Arabia little more than its name and its language. It was a system of Greek thought, expressed in a Semitic tongue, and modified by Oriental influences, called into existence amongst the Moslem people by the patronage of their more liberal princes, and kept alive by the intrepidity and zeal of a small band of thinkers, who stood suspected and disliked in the eyes of their nation. The Arabian philosophers have but a secondary interest in the history of their own lands. Their chief claim to the notice of the historian of speculation comes from their warm reception of Greek philosophy when it had been banished from its original soil, and whilst Western Europe was

still too rude and ignorant to be its home. In the annals of philosophy the period from the beginning of the 9th to the close of the 12th century may be styled the "Flight into Egypt." During these four centuries free thought found a refuge under Mahometan princes until her oppressors were dead. In the course of that exile the traces of Semitic or Mahometan influence gradually faded away; and the last of the line of Saracenic thinkers was a truer exponent of the one philosophy which they all professed to teach than the first. The whole movement was little else than a chapter in the history of Aristotelianism. That system of thought, after passing through the minds of those who saw it in the hazy light of an Orientalised Platonism, and finding many laborious but narrow-purposed cultivators in the monastic schools of heretical Syria, was then brought into contact with the ideas and mental habits of Islam. But those in whom the two currents converged did not belong to the pure Arab race. Of the so-called Arabian philosophers of the East, Al-Farabi, Ibn-Sina, and Al-Ghazali were natives of Khorassan, Bokhara, and the outlying provinces of north-eastern Persia; whilst Al-Kendi, the earliest of them, sprang from Basra, on the Persian Gulf, on the debatable ground between the Semite and the Aryan. In Spain, again, where Ibn-Badja, Ibn-Tofail, and Ibn-Roshd rivalled or exceeded the fame of the Eastern schools, the Arabians of pure blood were few, and the Moorish ruling class was deeply intersected by Jewish colonies, and even by the natives of Christian Spain. Thus, alike at Baghdad and at Cordova, Arabian philosophy represents the for a time victorious reaction of exotic ideas and of subject races against the theological one-sidedness of Islam, and the illiterate simplicity of the early Saracens.

Islam had, it is true, a philosophy of its own. There were Schoolmen amongst the believers in the Koran, not less than amongst the Latin Christians. At the very moment when Mahometanism came into contact with the older civilisations of Persia, Babylonia, and Syria, the intellectual habits of the new converts created difficulties with regard to its very basis, and showed themselves a prolific source of diversity in the details of interpretation. The radical questions on which these disputes turned were two. The first dealt with the possibility of ascribing manifold attributes to God—to a Being who was absolute unity. The other referred to the bearing of God's omnipotence upon the freedom of the human will. Ere the second century of the Hegira, sturdy adherents of the literal truth of the Koran taught a gross anthropomorphism, applying to the Creator the very bodily attributes of his creatures. These were the Sefaites, or partisans of the attributes. Another sect represented Mahomet as the teacher of an unqualified fatalism. Opposed to these narrow-minded exponents stood the comparatively liberal sect of the Motalzites, the Dissidents, who first appeared about 750. As they maintained, on one hand, that man was in some degree a free agent, and on another, elevated the unity of the divine nature far above the diversity of attributes, they came to be styled the partisans of justice and unity. It was with them that the Mussulman theology—the science of the word (*Calâm*)—first came into existence. Its professors, the *Motacallemin* (known in Hebrew as *Medabberim*, and as *Loquentes* in the Latin versions), may be compared with the scholastic doctors of the Catholic Church. Driven in the first instance to speculation in theology by the needs of their natural reason, they came, in after days, when Greek philosophy had been naturalised in the Caliphate, to adapt its methods and doctrines to the support of their views. They employed a quasi-philosophical method, by which, according to Maimonides, they first reflected how things ought

to be in order to support, or at least not contradict, their opinions, and then, when their minds were made up with regard to this imaginary system, declared that the world was not otherwise constituted. The dogmas of creation and providence, of divine omnipotence, chiefly exercised them; and they sought to assert for God an immediate action in the making and the keeping of the world. Space they looked upon as pervaded by atoms possessing no quality or extension, and time was similarly divided into innumerable instants. Each change in the constitution of the atoms is a direct act of the Almighty. When the fire burns, or the water moistens, these terms merely express the habitual connection which our senses perceive between one thing and another. It is not the man that throws a stone who is its real mover; the supreme agent has for the moment created motion. If a living being die, it is because God has created the attribute of death, and the body remains dead, only because that attribute is unceasingly created. Thus, on the one hand, the object called the cause is denied to have any efficient power to produce the so-called effect; and on the other hand, the regularities or laws of nature are explained to be direct interferences by the Deity. God is the sole cause or agent in the universe: it is He who, directly, or by the mediation of His ministering angels, brings everything to pass. The supposed uniformity and necessity of causation are only effects of custom, and may be at any moment rescinded. In this way, by a theory which, according to Averroes, involves the negation of science, the Moslem theologians believed that they had exalted God beyond the limits of the metaphysical and scientific conceptions of law, form, and matter; whilst they at the same time stood aloof from the vulgar doctrines, attributing a causality to things. Making the uniformity of nature a mere phantom due to our human customary experience, they deemed they had left a clear ground for the possibility of miracles.

But at least one point was common to the theological and the philosophical doctrine. Carrying out, it may be, the principles of the Neo-Platonists, they kept the sanctuary of the Deity securely guarded, and interposed between him and his creatures a spiritual order of potent principles, from the Intelligence, which is the first-born image of the great unity, to the Soul and Nature, which come later in the spiritual rank. Of God the philosophers said we could not tell what He is, but only what He is not. The highest point, beyond which strictly philosophical inquiries did not penetrate, was the active intellect, — a sort of soul of the world in Aristotelian garb — the principle which inspires and regulates the development of humanity, and in which lies the goal of perfection for the human spirit. In theological language the active intellect is described as an angel. The inspirations which the prophet receives by angelic messengers are compared with the irradiation of intellectual light, which the philosopher wins by contemplation of truth and increasing purity of life. But while the theologian incessantly postulated the agency of that God, whose nature he deemed beyond the pale of science, the philosopher, following a purely human and natural aim, directed his efforts to the gradual elevation of his part of reason from its unformed state, and to its final union with the controlling intellect which moves and draws to itself the spirits of those who prepare themselves for its influences. The philosophers in their way, like the mystics of Persia (the Sufites) in another, tended towards a theory of the communion of man with the spiritual world, which may be considered a protest against the practical and almost prosaic definiteness of the creed of Mahomet.

Arabian philosophy, at the outset of its career in the

9th century, was able without difficulty to take possession of those resources for speculative thought, which the Latins had barely achieved at the close of the 12th century by the slow process of rediscovering the Aristotelian logic from the commentaries and versions of Boëthius. What the Latins painfully accomplished, amid many senseless disputations and blind gropings after light, owing to their fragmentary and unintelligent acquaintance with ancient philosophy, was already done for the Arabians by the scholars of Syria. In the early centuries of the Christian era, but within and without the ranks of the church, the platonic tone and method were paramount throughout the East. Their influence was felt in the creeds which formulated the orthodox dogmas in regard to the Trinity and the Incarnation. But in its later days the Neo-Platonist school came more and more to find in Aristotle the best exponent and interpreter of the philosopher whom they thought divine. It was in this spirit that Porphyry, Themistius, and Joannes Philoponus composed their commentaries on the treatises of the Peripatetic system which, modified often unconsciously by the dominant ideas of its expositors, became in the 6th and 7th centuries the philosophy of the Eastern Church.

The energy of the Monophysites, however, began to sink with the rise of the Moslem empire; and when philosophy revived amongst them in the 13th century, in the person of Gregorius Barhebraeus (1226-1286), the revival was due to the example and influence of the Arabian thinkers. It was otherwise with the Nestorians. Gaining by means of their professional skill as physicians a high rank in the society of the Moslem world, the Nestorian scholars soon made Baghdad familiar with the knowledge of Greek philosophy and science which they possessed. But the narrow limits of the Syrian studies, which added to a scanty knowledge of Aristotle some acquaintance with his Syrian commentators, were soon passed by the curiosity and zeal of the students in the Caliphate. During the 8th and 9th centuries, rough but generally faithful versions of Aristotle's principal works were made into Syriac, and then from the Syriac into the Arabic. The names of some of these translators, such as Johannis (Honein ibn-Ishak), were heard even in the Latin schools. By the labors of Honein and his family the great body of Greek science, medical, astronomical, and mathematical, became accessible to the Arab-speaking races. But for the next three centuries fresh versions, both of the philosopher and of his commentators, continued to succeed each other.

To the Arabians Aristotle represented and summed up Greek philosophy, even as Galen became to them the code of Greek medicine. They adopted the doctrine and system which the progress of human affairs had made the intellectual aliment of their Syrian guides. It was a matter of historical necessity, and not an act of deliberate choice. Just as the early poets of Rome, when they tried to naturalise the drama, reproduced the works of Euripides, the popular tragedian of their time, so the Arabians, when the need of scientific culture awoke amongst them, accepted Aristotle. From first to last Arabian philosophers made no claim to originality; their aim was merely to propagate the truth of Peripateticism as it had been delivered to them. In medicine and astronomy, as well as in philosophy, they entertained an almost superstitious reverence for their Greek teachers. It was with them that the deification of Aristotle began; and from the belief that in him human intelligence had reached its limit passed to the later school-men. The doctrine is fixed: truth has been ascertained: all that is needed is a faithful and skilful interpreter. Hence, their perpetual labor of exposition and illustration; their epitomes and paraphrases of

Aristotelian doctrine. The progress amongst the Arabians on this side lies in a closer adherence to their text, a nearer approach to the bare exegesis of their author, and an increasing emancipation from control by the tenets of the popular religion.

Secular philosophy found its first entrance amongst the Saracens in the days of the early caliphs of the Abbaside dynasty, whose ways and thoughts had been moulded by their residence in Persia amid the influences of an older creed, and of ideas which had in the last resort sprung from the Greeks. The seat of empire had been transferred to Baghdad, on the highway of Oriental commerce; and the distant Khorassan became the favorite province of the caliph. Then was inaugurated the period of Persian supremacy, during which Islam was laid open to the full current of alien ideas and culture. The incitement came, however, not from the people, but from the prince: it was in the light of court favor that the colleges of Baghdad and Nisabur first came to attract students from every quarter, from the valleys of Andalusia, as well as the upland plains of Transoxiana. Al-Mansûr, the second of the Abbasides, encouraged the appropriation of Greek science; but it was Al-Mamûn, the son of Harûn al-Rashid, who deserves in the Mahometan empire the same position of royal founder and benefactor which is held by Charlemagne in the history of the Latin schools. In his reign (813-833) Aristotle was first translated into Arabic. Legend told how Al-Mamûn had been induced to send the Byzantine emperor for Greek books on philosophy, in consequence of a vision in which a venerable personage, who made himself known as Aristotle, had excited without gratifying the curiosity of the caliph. Orthodox Mussulmans, however, distrusted the course on which their chief had entered, and his philosophical proclivities became one ground for doubting as to his final salvation.

Unquestionably the most illustrious name amongst the Oriental Moslems was Avicenna (980-1037.) His fame in Europe rested more upon his medical canon than on his philosophical works; but even in logic and metaphysics his influence on the West was considerable. With him the encyclopædic tendencies of the school of Baghdad reached their culmination. He was followed by Algazel (Abou-Hamed Mohammed ibn-Mohammed al-Ghazâlî), whose name was the last that attained a European reputation. Born near Tûs in 1058, he studied there and at Nisabur; and having left his native province of Khorassan at the age of 36, he was appointed to a high educational post at Baghdad. There, as well as at Damascus, Jerusalem, and Alexandria, his lectures attracted crowds of eager listeners. Suddenly he withdrew from active life, assumed the habits of the Sufite mystic, and devoted himself to contemplation of religious truth; and although he was persuaded to resume for awhile his duties in the college of Baghdad, he soon returned to seclusion, and passed his last days in a monastery which he had himself founded at Tûs (1111). The 12th century exhibits the decay of liberal intellectual activity in the Caliphate, and the gradual ascendancy of Turkish races animated with all the intolerance of semi-barbarian proselytes to the Mahometan faith. Philosophy, which had only sprung up when the purely Arabian influences ceased to predominate, came to an end when the sceptre of the Moslem world passed away from the dynasty of Persia. Even in 1150 Baghdad had seen a library of philosophical books burned by command of the Caliph Mostandjed; and in 1192 the same place might have witnessed a strange scene, in which the books of a physician were first publicly cursed, and then committed to the flames, while their owner was incarcerated.

The same phenomena were repeated in Spain under the Mahometan rulers of Andalusia and Morocco, with this difference, that the time of philosophical development was shorter, and the heights to which Spanish thinkers soared were greater. The reign of Al-Hakem the Second (961-976) inaugurated in Andalusia those scientific and philosophical studies which were simultaneously prosecuted by the Society of Basra. From Cairo, Baghdad, Damascus, and Alexandria, books both old and new were procured at any price for the library of the prince; 27 free schools were opened in Cordova for the education of the poor; and intelligent knowledge was perhaps more widely diffused in Mahometan Spain than in any other part of Europe at that day. The mosques of the city were filled with crowds who listened to lectures on science and literature, law and religion. But the future glory thus promised was long postponed. The usurping successor of Hakem found it a politic step to request the most notable doctors of the sacred law to examine the royal library; and every book treating of philosophy, astronomy, and other forbidden topics, was condemned to the flames.

Arabian philosophy, whilst it promoted the exegesis of Aristotle and increased his authority, was not less notable as the source of the separation between theology and philosophy. Speculation fell on irreligious paths. In many cases the heretical movement was due less to foreign example than to the indwelling tendencies of the dominant school of Realism. But it is not less certain that the very considerable freedom of the Arabians from theological bias served indirectly to intensify the prevailing protest against Sacerdotalism, and prepared the time when philosophy shook off its ecclesiastical vestments. In the hurry of first terror, the church struck Aristotle with the anathema launched against innovations in philosophy. The provincial council of Paris in 1209, which condemned Amalricus and his followers, as well as David of Dinant's works, forbade the study of Aristotle's Natural Philosophy, and the Commentaries. In 1215 the same prohibition was repeated, specifying the Metaphysics and Physics, and the Commentaries by the Spaniard Mauritius (*i.e.*, probably Averroes). Meanwhile Albertus Magnus and Thomas Aquinas, accepting the exegetical services of the Arabians, did their best to controvert the obnoxious doctrine of the Intellect, and to defend the orthodoxy of Aristotle against the unholy glosses of infidels. But it is doubtful whether even they kept as pure from the infection of illegitimate doctrine as they supposed. The tide meanwhile flowed in stronger and stronger. In 1270 Stephen Tempier, bishop of Paris, supported by an assembly of theologians, anathematised thirteen propositions bearing the stamp of Arabian authorship; but in 1277 the same views and others more directly offensive to Christians and theologians had to be censured again. Raymond Lully, in a dialogue with an infidel thinker, broke a lance in support of the orthodox doctrine, and carried on a crusade against the Arabians in every university; and a disciple of Thomas Aquinas drew up a list of the several delusions and errors of each of the thinkers from Alkindius to Averroes. Strong in their conviction of the truth of Aristotelianism, the Arabians carried out their logical results in the theological field, and made the distinction of necessary and possible, of form and matter, the basis of conclusions in the most momentous questions. They refused to accept the doctrine of creation because it conflicted with the explanation of forms as the necessary evolution of matter. They denied the particular providence of God, because knowledge in the divine sphere did not descend to singulars. They excluded the Deity from all direct action upon the world, and substituted for a

cosmic principle the active intellect—thus holding a form of Pantheism. But all did not go the same length in their divergence from the popular creed.

ARABIAN SEA, the name applied to the large sheet of water, really a portion of the Indian Ocean, bounded on the E. by Hindustan, on the N. by Beloochistan, on the W. by Arabia and the Gulf of Aden, and on the S. by an imaginary line stretching between Cape Guardafui, in the N. E. of Africa, and Cape Comorin in Hindustan. This is the Arabian Sea proper, but under the name Gulf of Aden it penetrates between Africa and Arabia, connecting itself with the Red Sea through the Straits of Bab-el-Mandeb; while on the N. W. the Gulf of Oman, with its continuation the Persian Gulf, separates Arabia from Beloochistan and Persia. Besides these larger ramifications, there are the Gulfs of Cambay and Cutch in the N. W. of India. An interest and importance belong to this sea as forming part of the chief highway between Britain and India. The islands it contains are few and insignificant, the chief being Socotra and the Laccadives.

ARABICI, a sect originating about the beginning of the 3d century, which is mentioned by Augustine (*De Hæres.*, c. 83), and called also *Thnetopsychita* by Johannes Damascenus (*De Hæres.*, c. 99). Its founder is unknown, and its history brief and obscure. Its distinctive doctrine was a form of Christian materialism, showing itself in the belief that the soul perished and was restored to life along with the body. According to Eusebius, the Arabici were convinced of their error by Origen, and renounced it at a council held about 246 A. D.

ARACATI, a town of Brazil, in the province of Ceara, situated on the Jaguaribe, about 10 miles from its mouth. It is well built, and carries on a considerable export trade in hides and cotton. The population is stated at 26,000.

ARACHNIDA.—The Arachnida, or, popularly speaking, the Spiders and their allied forms, constitute a well-defined group within the great branch "Articulata" of the animal kingdom, though on one side its boundary lines melt almost insensibly into the Annelides, through the family of acarids—*Pentastomides*. Linnaeus and others of the older systematists included all Arachnids (as then recognized) under the class *Insecta*, Lamarck first separating them into a distinct class. A few general remarks, therefore, on the branch *Articulata*, and its subordinate groups, may be useful, to show the general relation of that under consideration.

As distinguished from the *Vertebrata*, the animals of the branch *Articulata* may be characterized generally as having (besides the marked and uniformly different position of the chief organ of circulation and the nervous chords) an external skeleton, the different parts of which, of more or less solid consistency, are articulated, or joined to each other, and contain within their hollows the vital and other organs. Internally, threads of nervous matter, springing from enlargements or knots (*ganglia*) upon two or more central longitudinal nervous chords on the ventral side of the body traverse the different parts of it; these chords, however, end in one special mass corresponding to the brain in the *Vertebrata*; and the nervous systems composed by these ganglia vary considerably in their special structure and arrangement in the different subordinate groups.

This being the distinctive plan of structure in the *Articulata*, a review of the whole group shows us that this plan is carried out in two well-marked leading ways—first, *without*, and secondly, *with*, articulated legs, or organs of locomotion and touch. Those *without* articulated limbs constitute the *Annelides* of Lamarck, which for our present purpose, it is sufficient to charac-

terise as having the articulate plan of structure carried out in the general form of a more or less cylindrical, lengthened body, composed of a number of rings, segments, or transverse folds, of which the first forms the head, but destitute of articulated limbs. Those with articulated legs constitute the *Condyllopa* of Latreille, or the *Insecta* of Linnaeus; but the term *Insecta* being now in general use to define a subordinate group, it will be better to adopt here the name given by Latreille. In the "*Condyllopa*," then, the articulated plan of structure is carried out in the form of a more or less hard body composed of different pieces, of which one, two, three, or more, are generally *leading ones*; to this body (in general to the anterior portion of it) are attached *articulate organs of locomotion* various in number, but never, or at least very rarely, less than six. The organs of sight (when present) are always in the head, and vary in number, position, and kind. To these two leading divisions of the branch *Articulata*—the *Annelides* of Lamarck, and the *Condyllopa* of Latreille—we may give the designation of CLASSES, since they are each respectively composed of animals which thus primarily and markedly differ in the way in which their common articulate plan of structure is carried out.

Leaving now the class *Annelides*, to which has been given the name "Anarthropoda," and confining our attention to the "*Condyllopa*," or "*Condyllopoða*" (equivalent to the "*Arthropoda*" of more modern authors), we find that the latter contains the four following groups—"Insecta," "*Myriapoda*," "*Arachnida*," and "*Crustacea*."

These all agree in the way which, as above explained, their general articulated plan of structure is carried out, but they differ in the further modifications of this plan, that is to say, in the number, division, and size (both absolute and relative) of the different articulations of the body (including the organs of locomotion, of manducation, and of touch), and in the respective value and relation of these to each other, as well as in the modifications of their respiratory and other internal systems and also in other important points. Differing thus from each other, these four groups, usually (three at least of them) ranked as distinct classes, yet appear to be entitled only to the rank of sub-classes, being each merely an equally subordinate group of the class "*Condyllopoða*."

The four sub-classes of *Condyllopoða* (or articulated *Annulosa*) may be separately and briefly characterised thus:

Sub-class I.—INSECTA: subject in general to metamorphosis, more or less complete, during the progress to maturity; organs of locomotion, six; body divided into three principal parts—*caput*, *thorax* and *abdomen*; respiration wholly tracheal.

Sub-class II.—MYRIAPODA: not subject to metamorphosis, properly so-called; organs of locomotion above six in number (twenty-four and more) developed by degrees, and affixed to the abdominal as well as to the other (numerous) segments into which the body is divided. Although occasionally some of the anterior segments coalesce, and the head is stated to be formed by five or more modified segments, yet no one or more parts of the body can be said to be principal ones; respiration is tracheal.

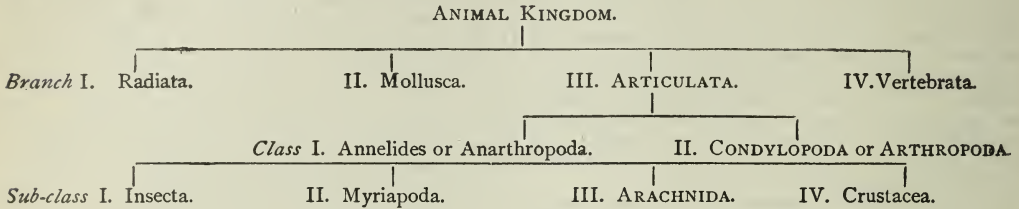
Sub-class III.—ARACHNIDA: not subject to metamorphosis, properly so-called, though as with the *Myriapoda*, some portions of structure among certain acarids, and to a small extent even among the *Ara-neidea*, are progressively developed at the various moultings of the skin. Organs of locomotion, eight; body in general divided into two principal parts, *cepi-*

alo-thorax and abdomen; but where (as in some groups) the abdomen is divided into more or less distinct segments no organs of locomotion are ever attached to them; respiration, where distinct organs exist, is either tracheal, pulmo-branchial, or the two co-existent.

Sub-class IV.—CRUSTACEA: without metamorphosis; organs of locomotion various in number (not less than eight or ten), and attached to some or all of the many segments, abdominal as well as others, into which the body is divided; although in numbers of crustaceans no

one part of the body can be called a principal part, yet in some very large and leading groups, the portion covered by the carapace (corresponding to the cephalo-thorax in Arachnids) may well be termed the *one* principal part; the abdomen being in this case more or less rudimentary or subordinate. Respiration in the Crustacea, where distinct organs are present, is branchial.

In this view the following diagram shows the relative positions of the several leading groups of the Articulata:



In this diagram the Myriapoda are placed, in the position ordinarily assigned to them, between the Insects and Arachnids; but perhaps a more natural position would be after the Crustacea, for they appear to connect the Insecta and Crustacea more than they do the Insecta and Arachnida. The point, however, of the special position of any large group in a linear series is tolerably unimportant. A linear arrangement is of course the only one possible on paper, but it cannot express the numerous cross relationships that become evident when the affinities of special groups are closely studied. By placing the Myriapoda after the Crustaceans, we seem to get an ascending series in respect to the organs of locomotion: in the *Insecta*, six — always attached to the thoracic segments; in the *Arachnida*, eight — almost always attached to the thoracic segments; in the *Crustacea*, eight, ten, and upwards — frequently attached to the abdominal as well as the thoracic segments; in the *Myriapoda*, twenty-four and more — always attached to the abdominal as well as other segments. The relation of the Myriapoda to the Crustacea through the attachment of limbs to the abdominal segments is thus expressed; and by the meeting of the two ends of the line, the always acknowledged affinity of the former to the Insecta is also expressed.

Having thus briefly explained the most obvious relationships of the Arachnida, let us now proceed to a more detailed, though still general, diagnosis of this group. And first, in respect to their *external organisation*, Arachnids are articulate animals, with eight articulated legs, each in general consisting of seven joints; the head and thorax are soldered together into one piece (cephalo-thorax), from which with few exceptions the legs invariably spring. In one group of the Arachnida (*Solpugidea*) the cephalo-thorax is separately segmented, as it is also in one family of the *Thelyphonidea* (*Tartarides*); the rest of the body forms also one more or less homogeneous piece (abdomen). The abdomen is always more or less closely attached to the cephalo-thorax; in some instances it is soldered to the thorax, and forms with it one undivided piece, in other cases it is only joined to it by a narrow pedicle. At times, also, the abdomen constitutes a simple unsegmented portion, at other times a segmented or annulate portion of the body, occasionally, as in the true scorpions, prolonged into a segmented tail; in one small but very distinct group (*Thelyphonidea*), the abdomen is prolonged into either a simple button, a short jointed, or a more or less long setiform tail; in another large group (*Araneidea*) the abdomen terminates with

organs (spinners and spinnerets) for spinning threads. The *eyes* (when present) are simple, always sessile, and placed on the fore part of the cephalo-thorax; they seem to represent the simple ocelli of the Insecta; the large compound eyes of that order having here no representation, the caput of Arachnids appearing to begin at a point posterior to that which bears the antennæ and compound eyes of insects. In Arachnida the number of eyes varies from two to twelve. In front of and articulated beneath the fore part of the cephalo-thorax, and moving in different planes in different groups, are two independent, variously modified, organs for seizing and compressing the insects and other substances on which Arachnids in general prey; these organs are often called mandibles, but more generally, and very appropriately, *falces*: these are considered by some systematists to be the true homologues of the antennæ in insects, and to have been derived from those portions of the insect organisation by long and unceasing modification; when, however, the caput of an Arachnid (scorpion or spider, for instance) is compared with that of a coleopterous or hymenopterous insect, in which the mandibles are well developed, there seems far more reason to conclude that the antennæ of the insect have no homologue at all in Arachnid (Claparède, *l.c. post.*), but that the falces of the latter are the true representatives of the mandibles of the former. Behind the falces (and also used in mastication) are two other large movable portions of structure called maxillæ; these vary in shape and size, and form in fact lateral and hinder boundaries to the mouth, as well as an apparatus for comminuting and squeezing the food substances; from each of these maxillæ, on the outer side springs a palpus of four or five joints, varying in structure and use. Between the maxillæ most Arachnids have also a fixed piece (*labium*) of various form, completing the hinder limits of the mouth organs, and in some (perhaps in most) there is, within the parts already named, another portion (*tongue*), not yet sufficiently observed either in regard to its form or use, but probably acting so as to hinder choking. In some Arachnids these different parts of the mouth are soldered together and form a tolerably simple sucking apparatus, analogous to the mouth of some insects (*Hemiptera*, &c.) As observed above, Arachnids are not, in a proper sense, subject to metamorphosis: in most of them there is little real change after they leave the egg; though, in some of the lowest forms, indeed, there are after changes by moultings of the skin, which approach the incomplete metamorphoses of some insects.

With respect to the *internal organisation* of the Arachnida, it might perhaps be enough here to refer to the more detailed accounts given further on, where the separate *orders* are under consideration; but the following summary will probably make our general view of the whole sub-class more complete.

Muscular System.—Of this it is enough to say that it is similar to that of the rest of the Articulata, consisting of flexor and extensor muscles, situated within the hollows of the limbs, besides groups of fibres by which the epidermis and parts within it are connected and held together. On the outer surface these groups frequently show, at their points of union, boss-like marks or foveæ, or impressed spots of various forms and sizes, often presenting by their position distinctive peculiarities of form; it is probable that many others of the external specific markings are dependent on the course and position of the muscular fibres, as well as of the heart and other organs.

Circulatory System.—The vital fluid is circulated by means of an elongated muscular vessel or heart, varying in form, and, instead of being placed, as in the Vertebrata, on the ventral side of the body, extending along the back of the abdomen. This vessel is often divided into chambers or compartments by valves, having also valvular orifices on its upper side for the flowing in of the fluid (Newport), and giving off vessels (arteries) for its distribution to the rest of the body. In the lower forms, however, of Arachnids (among the *Acaridea*) no such principal muscular vessel is found, the vital fluid being in such cases supposed to circulate generally in the body, and to be distributed irregularly into different portions by the muscular movements of the intestinal canal.

Respiratory System.—Arachnids breathe by means of *tracheæ* (spiracular tubes, as in the Insecta), as well as by *pulmo-branchiæ*, said to be a kind of compound of the gill of fish and the lung of mammals, though in reality there seems better reason to consider the *pulmo-branchiæ* as merely peculiarly modified *tracheæ*; both these organs have external orifices (*stigmata*) variously situated, but commonly in some part of the abdomen. In some Arachnids (certain groups of the *Araneidea*) respiration is effected by both of the above organs; while in others (certain of the *Acaridea*) no distinct organs of respiration exist.

Digestive System.—Digestion is effected by a simple alimentary tube or canal running from the mouth to the anus. This tube is various in its form, as well as in the intestines issuing from it; in some groups, as the *Araneida* and *Acaridea*, the above canal has large lateral cæcal appendages; in others (*Scorpionides* and *Thelyphonides*) the alimentary canal has no such lateral enlargements. In some Arachnids there have also been found a liver (or mass of substance in the abdomen exercising the functions of a liver), an organ performing the part of kidneys, and salivary glands, often of large size, while in others no distinct organs of digestion exist.

Nervous System.—This consists of ganglia or nerve-knots, formed by enlargements of longitudinal nervous cords (generally two in number), differing in position and in the nerves issuing from them. In one large group (*Acaridea*) where the abdomen usurps, as it were, the place of all the rest of the body, there is no longitudinal nerve cord; a single nerve mass occupies the interior of the abdomen, and sends forth nerves to the various surrounding parts.

Generative System.—Generation is effected by two distinct and separate sexes, the single exception known being the *Pardigrada*, a group of *Acaridea* approaching nearly to the Entozoa, and said to be hermaphrodite. In females the parts of generation consists of two sacs

(*ovaria*), one on each side of the alimentary canal. These have a common external orifice (*vulva*), various in its shape, beneath the anterior extremity of the abdomen; and connected with this opening there is frequently an epigyne, or ovipositor, often of some length, and of characteristic form. In *males* (except among the phalangids and scorpions) there is no intromittent organ,—the generative parts consisting of two long tubes, similarly situated to the *ovaria* in females, in which the seminal fluid is secreted; these tubes end in a simple external, very minute orifice, in a similar situation to the vulva of the female.

Arachnids are either oviparous or ovo-viviparous. As before observed, they undergo no proper metamorphosis, but as growth takes place there are more or fewer successive moultings of the skin; and complete development of all the parts does not occur until the last moult, when the creature becomes adult, and so fitted to perpetuate its kind.

With regard to the position held by Arachnids in the great scheme of nature, it seems, from the considerations shortly entered into above, undeniable that they are very closely linked to the rest of the Articulata by much, both of external and internal structure, common to the whole branch. The office they subserve is evidently the keeping down of the superabundant supply of the insect world; some even operating to check the too rapid advance of higher animals.

Assuming that the operation, in some shape or other, of evolution has brought the different groups of Articulata to the varied forms and conditions they now respectively present, it is plain that the higher, at least, of the arachnidous orders must, in all probability, have been modified from some one or more of the other groups, perhaps in the main from the Insecta and Myriapoda,—certainly not the Insecta, for instance, from the Arachnida. Thus, we should define Arachnids, generally, to be insects modified for the purpose of preying upon their congeners; while some of the lower forms of Arachnids, such as *Demodex*, *Tardigrada*, and *Pentastoma*, carry us back to the remote past, before the branch Articulata, in any of its great groups, had attained more than a very slight progress towards its present dignified and highly organised forms.

The above being a general summary of the external and internal organisation of the Arachnida, an examination of the whole group shows us that their different characters, and the ways in which their articulated plan of structure is carried out, are variously correlated and modified, forming structural complications of several marked kinds, whence we get the different *orders*, being the next subordinate groups, into which Arachnids are divided. These *orders* are seven in number, and form so many well-defined groups, but of very different extent. Advancing from the more simple to the more highly organised, we begin with the *Acaridea*, comprising the mites and ticks, and including also the *Tardigradides*, *Pentastomides*, as well as *Demodex*. The second order is that of the *Pycnogonidea*, marine parasites, which, in a certain plane, appear to connect the *Acaridea* with the next or third order, *Phalangidea*; these last are popularly known as "Harvest-men." Next to them, and forming the fourth order, come the *Solpugidea*, a small but very distinct group, constituting a link in one plane between the *Phalangidea* and *Scorpionidea*, which last, including the Chelifers, or False Scorpions, form the fifth order. Not far removed from these is the sixth order, *Thelyphonidea*, comprising groups which partake of the characters both of the *Scorpionidea* and of the next—the seventh and last—order, *Araneidea*, or true Spiders.

Sub-Class.—ARACHNIDA.

Orders.—I. Acaridea. II. Pycnogonidea. III. Phalangidea. IV. Solpugidea. V. Scorpionidea.

VI. Thelyphonidea. VII. Araneidea.

The following abstract shows the chief ordinal characters of these seven groups of Arachnids:—

Order I. ACARIDEA.—Cephalo-thorax and abdomen united so as to form one piece, generally without united so as to form one piece, generally without mark of union; palpi and falces variable in structure; the several parts of the mouth often united; legs terminating variously, generally eight in number, sometimes only six in the immature state, and in one or two instances but four, even when adult; eyes, when present, variable in number (2 to 6), and placed on the cephalo-thorax; respiration, when proper organs for it exist, wholly tracheal; nervous matter gathered into one large mass, or ganglion; reproduction ovo-viviparous as well as oviparous. Maturity is reached by quasi, or imperfect, metamorphoses in some of the groups.

Order II. PYCNOGONIDEA.—Cephalo-thorax segmented, linear; abdomen rudimentary, forming merely a small terminal segment to the cephalo-thorax; the mouth consisting of the termination of a tubular article forming the head, sometimes accompanied by some more or less distinct parts; legs eight, multi-articulate; in females a supernumerary pair, between the first two and used for bearing ova; organs of respiration, none; metamorphosis imperfect, as in the last order.

Order III. PHALANGIDEA.—Cephalo-thorax and abdomen of tolerably equal size, and united throughout their whole breadth, but the junctional line evidently marked; abdomen annulate or segmentate, caused by transverse folds in the epidermis; falces two-jointed, didactyle; legs in general inordinately long, and very slender; the two terminal joints multi-articulate, and ending with claws; eyes two, on the vertex of cephalo-thorax; respiration tracheal; reproduction oviparous; no metamorphosis of even an imperfect kind.

Order IV. SOLPUGIDEA.—Cephalo-thorax distinct from the abdomen and segmented, the first segment forming the head; abdomen annulate; falces one-jointed, didactyle; palpi terminating with a capsule containing a peculiar organ, the use of which is not yet known; eyes two, on a small eminence at the fore part of the head in the medial line; respiration tracheal; legs terminating with two curved fingers; manner of progressive growth unknown.

Order V. SCORPIONIDEA.—Cephalo-thorax formed of one undivided piece, united to the abdomen throughout its entire breadth; abdomen annulate, prolonged (in one of the families) into a segmented tail, ending with a poison bulb armed with a sharp perforated point, through which the poison is emitted; falces didactylous; palpi terming with a didactyle claw; eyes variable in number, two to twelve, variously grouped on the fore part of the cephalo-thorax; respiration, in one family, tracheal, in another, pulmo-branchial; ganglia several, distributed along the nervous chord; reproduction in some oviparous, in others ovo-viviparous; organs for spinning beneath the fore part of the abdomen in one family; no metamorphosis.

Order VI. THELYPHONIDEA.—Cephalo-thorax undivided, but its segmental structure generally visible in grooves and furrows, following the course of the soldered joints; abdomen annulate, joined to the cephalo-thorax by a pedicle; palpi very strong, didactylous (in a modified form); falces monodactylous; legs of the first pair excessively long, antenniform, the last joints very fine, multi-articulate, and devoid of a terminal claw; eyes, when present, eight, disposed in three groups on the fore part of the cephalo-thorax; abdomen either terminating with a button-like segment, a

short two-jointed tail, or a multi-articulate setiform one; respiration pulmo-branchial; manner of progressive development unknown. In one family, ganglia two, closely united; in others unknown. closely united; in others unknown.

Order VII. ARANEIDEA.—Cephalo-thorax undivided, but traces of segmentation commonly more or less visible, united to the abdomen by a narrow pedicle; abdomen without segments or annuli, ending with organs for spinning; falces monodactylous; palpi more or less filiform in males, with the last joint more or less complicated in structure, and used in copulation, terminating in females (but not invariably) with a claw or claws, sometimes pectinated; legs terminating with two or three curved claws, and, except the third (which is rarely so), generally more or less pectinated; ganglia two or three in number; respiration tracheal, as well as pulmo-branchial; reproduction oviparous.

The last order of Arachnids or true spiders consists, like others of the sub-class Arachnida, of a body divided into two parts—cephalo-thorax and abdomen; but these are united only by a slender pedicle, and neither is segmented, ringed, or articulated, nor (in respect to the abdomen) covered with horny plates, except in two instances—*Liphistius desultor* (Schödte) and (but partially only) *Tetrablemma medioculatum* (Cambridge), both exceedingly rare and remarkable species. The cephalo-thorax, though undivided, yet shows by its various, and more or less strongly marked, converging grooves and indentations, that it is composed of the ordinary cephalic and thoracic segments soldered together; and although these segments form but one undivided portion of structure, it is necessary to speak of it frequently by the names of its two portions—caput and thorax. The caput is almost always easily traced, forming a kind of wedge shaped portion, jammed (as it were) into the first of the thoracic segments, and giving one the idea, in most cases, of its fore part having been to a greater or less extent truncated or lopped off. Similarly the last of the four thoracic segments has the appearance of having been driven in to meet the caput, all the segments thus converging, on the upper side, towards a common fovea, or more or less deep central indentation, and on the under side forming a sternum (or sternal plate), in which, however, no appearance of segmentation is generally visible beyond small eminences opposite to the articulation of the legs, with which the number of the thoracic segments, as seen above, agrees. The integument of the cephalo-thorax is either hard, horny, or coriaceous, generally more or less clothed with hairs and bristles, and sometimes, though more rarely, with tubercles and spines; occasionally it is perfectly smooth and glabrous. The eyes, when present, are two, four, six, or eight, and are very variously, but always symmetrically, disposed on the fore part of the caput. The number and general position of the eyes form valuable characters for the formation of genera.

The legs, eight in number, are articulated to the sternal plate (mentioned above) which forms the under side of the cephalo-thorax; in one genus, however, (*Miagrammopes*, Cambr.), found in Ceylon and Australia, no sternum properly so-called exists, the legs being articulated to the continuous under side of the cephalo-thorax. Except in one or two species the legs are seven-jointed, and variously furnished with hairs, bristles, and spines. Many spiders have a kind of pad of closely set papillae-form hairs beneath the extremity of the tarsi of some or all the legs, and often extending along the whole of the under side of the joint. This

pad enables the spider to run over smooth vertical surfaces, acting as a kind of sucker, partly by atmospheric pressure, and partly (Mr. Blackwall thinks wholly) by means of a viscid secretion from the papillæ-form hairs. Each tarsus ends with either two or three more or less curved or bent claws, commonly (but not always) pectinate or finely denticulated; these (with other opposed serrated claws, in some groups) are used in traversing their web, and as hooks to give a tension to the line of their snares by alternately pressing and straining upon them; the spines and bristles are used also in many cases in the actual construction of the silken snares in which spiders entrap their prey. The spines on the legs of some spiders which excavate cylindrical holes in the earth (lined with silk and closed with a hinged lid) are very strong and well suited for digging out the soil. The males of some species, again, have a curious row of short, closely set, curved, spiny bristles along a portion of the upper side of the metatarsi of the fourth pair of legs; the use of this row of bristles (called the *calamistrum*) is alluded to further on. The length of the legs in spiders (both actual and relative) is very various; and the differences between them, as well as their armature and terminal claws, furnish valuable characters, often generic, and always important in the determination of species.

The *falces*, two in number, are articulated immediately before the low margin of the caput; their direction is various, ranging from a line parallel to the plane of the cephalo-thorax to one perpendicular to it; they are in general opposed to each other, and in most cases are armed with teeth on their inner surface, especially toward their extremities; each also terminates with a movable curved fang, which, when not in use, is (according to its mode of articulation) folded down either across the inner side of the extremity of the falk, or (as in one extensive family, *Theraphosides*) backwards along its length; by means of these fangs, which are internally channelled and perforated at their extremities, a poison secreted within the caput is instilled into the wound made by them, proving, no doubt, fatal to the spider's prey, and often nearly so to human beings. Not to dwell upon the, probably exaggerated, accounts of the Tarantula, there are well-authenticated instances of recent date in regard to the very deadly nature of the poison of quite a small spider, *Lathrodectus Katipo* (Ll. Powell), found in New Zealand *Trans. N. Z. Instit.* iii. p. 56; also *Id.* ii. p. 81, and iii. p. 29. A larger European species of the same genus, *L. oculatus* (Walck.), also bears the reputation of being venomous.

The *maxillæ* are a conspicuous, as well as important, portion of structure in the Araneidea; they are two strong pieces situated immediately behind the falces, exceedingly varied in form and strength, and articulated to the fore side of the sternum between the basal joints of the first pair of legs. Their real direction is always divergent, *i.e.*, outwards from each other, but as in most cases the inner extremity is produced into an apophysis of greater or less size (sometimes following the direction of the maxilla, sometimes curved so that its extremity almost touches that of the opposite maxilla), the maxilla itself often seems lost in the part which projects from it. Owing to this, the pulpus which springs from each maxilla, although really always springing from its extremity, appears more frequently to issue from its outer side; and, in fact, it can hardly in those cases be described (without leading to some confusion) as issuing in any other way. The form of the maxillæ, together with the apparent point of palpal issue, constitutes one of the most valuable characters for the establishment of genera.

The *palpi*, issuing from the maxillæ as just described,

are two (in both sexes of *many* and in the female sex of *most* species, leg-like) limbs, of five or (counting the basal joint—maxilla—to which each is articulated) six joints; in the female spider the palpi generally end with a single, and sometimes denticulate, curved claw; in some instances, however, there is no terminal palpal claw; but in the male, the third (*cubital*) and fourth (*radial*) joints of the palpi are (the former often, the latter always) characterized by prominences, spiny apophyses, or protuberances, which furnish some of the strongest, as well as most tangible, specific characters of that sex; the last (or *digital*) joint of each palpus (in the male spider) is generally more or less concave, and always includes, either within its concavity or articulated to its under side, a (frequently complex) congeries of corneous lobes, spines, and spiny processes, in some instances articulated to each other so as to be capable of being opened out as by hinges. These are not developed until the spider arrives at maturity. Up to that period the digital joint has a tumid and somewhat semi-diaphanous appearance, and, although commonly smaller, bears the same general form that it has after maturity. These processes, or, as they are called, *palpal organs*, are connected with the process of reproduction—the fecundation of the female. This subject, however, we shall have occasion to refer to again. The palpi are generally furnished more or less with hairs, bristles, and spines, like the legs; and like them also, are reproduced after accidental loss.

The *labium* is also another important portion of structure; it is situated at the fore extremity of the sternum, between and in front of (or rather beneath) the maxillæ; it is of varied form and size, and stopping the gap between the maxillæ, it completes with them the inferior and lateral boundaries of the mouth, the falces forming its upper limits. The labium is always present, except in a new and very remarkable Brazilian spider, *Aphantochilus Rogersii* (Cambr.), in which the labium is wanting and yet not wanted, because the maxillæ, in this instance, close up to each other, leaving no gap between them.

Between the labium and falces is another portion of structure, the *tongue*; it is, no doubt, by the aid of this that the act of swallowing the juices of insects, when expressed by the falces and maxillæ, is effected; that, in fact, the spider eats without being choked. No use hitherto has been made of the tongue in spiders for purposes of classification, but the form of the *labium* is very useful for the characterisation of genera. These parts — falces, maxillæ, labium, and tongue — thus complete the mouth-parts of a spider.

The *sternum* has already been mentioned; its form varies from oval to heart-shaped, and sometimes somewhat pentagonal; its convexity also varies considerably; its use in classification is rather limited, but with its clothing of hairs, bristles, or pubescence, or its sometimes glabrous nature, it generally has some specific importance. In one known genus only, as mentioned above, is the sternum wanting.

The *abdomen* is exceedingly varied in form in different families; it is united to the cephalo-thorax by a short narrow pedicle, and generally terminates with organs for spinning; in one species, *Liphistius desultor* (?) (Schödte), the spinners are placed near the anterior part of the under side of the abdomen; and in another, *Mutuca mammosa* (Cambr.), one pair only are so placed, the rest occupying the ordinary position. The number of spinners varies — two, four, six, or eight; they are placed in pairs, and when a fourth pair is present it is, usually as a single one, united throughout its length (but with often a line of division visible), and occupying a transverse position in front of the rest. It is

but very lately that spiders have been observed with two spinners only; see "Spiders of Palestine and Syria," O. P. Cambridge, *Proc. Zool. Soc.* 1872, p. 260; *Ann. and Mag. N. H.* 1870, pp. 414-417, *Ibid.*

The *spinners* consist of from one to three joints, and vary greatly in size and structure, as well as in number, but their use in classification has not hitherto been as great as might have been expected; generally they are separate, but in *Tetrablemma* (Cambr.) they are enclosed in a kind of corneous sheath. Those of the fourth pair when present (which they are in both sexes) are correlated, but in general only in the female sex, with the calamistrum, or double series of curved bristles before mentioned, on the metatarsi of the fourth pair of legs. The function of the calamistrum has been proved by Mr. Blackwall to be the carding, or teasing and curling, of a peculiar kind of silk, secreted and emitted from the fourth pair of spinners; when thus prepared this silk becomes adhesive, from its minutely divided and elastic fibres; and, disposed about the lines of the spiders' snares, it renders more easy the entanglement and capture of their prey. Immediately above the spinners is a small nipple-like prominence which indicates the anal orifice.

The abdomen is covered with a continuous integument neither annulate nor segmentate; in one species, however (before mentioned), *Liphistius desulitor* (Schödté), the upper side has a longitudinal series of transverse corneous plates, like those of the Phrynides; and something of a similar kind, but less marked, is observable in *Tetrablemma medioculatum* (Cambr.), a very rare and remarkable little spider found in Ceylon. The epidermis of the abdomen is of various kinds and consistency in different groups, sometimes excessively thin and tender, at other times tough and coriaceous, and sometimes hard and horny, with a varied armature and clothing of hairs, bristles, pubescence, tubercles, and spines, sometimes being, however, perfectly bare and glabrous; its colors, also, and the patterns produced by their distribution, vary exceedingly. Underneath the fore extremity of the abdomen are placed the external openings to the respiratory organs; these apertures consist of a narrow slit or orifice under the fore edge of round or oval scale-like plates, placed on each side of the median line; such plates are in some spiders four in number, but for the most part only two. Other spiracular openings also exist in many spiders, both at the anterior part of the under side and near the spinners (Siebold), but these are usually far less perceptible than the others before mentioned, and often discoverable with great difficulty. The ordinary pair of spiracular plates are in general very conspicuous, commonly differing in color from the surrounding surface, and sometimes slightly pubescent. They occupy each side of the median line at the extreme fore part of the under side of the abdomen; and between them is, in the male spider, a very minute orifice which leads to the seminal organs; while in the same situation in the female is an aperture usually rather conspicuous, always of characteristic form, and often furnished with a corneous process of greater or less development. This aperture is the vulva, and the process (when present) probably has the function of an ovipositor. The form and structure of this aperture is of great use in the determination of species, but until the female spider attains maturity no aperture at all is visible. The orifices to the breathing organs are fringed with hairs or lashes, and open and close by an internal muscular arrangement. The other pair of spiracular plates, when present, are in some cases close behind those above mentioned, but more commonly at some distance further towards the hinder extremity of the abdomen.

On the upper side of the abdomen may be seen in many spiders several impressed spots or dots, differing in number and position in different genera and species, but always placed symmetrically. These, considered by Treviranus as stigmatic openings, are probably indicated points of fixture for muscles beneath the integument, being apparently imperforate. Smaller puncture-like marks are also visible on the under side, and are perhaps similarly caused. The hairy clothing of the abdomen (as well as of the cephalo-thorax and other parts), variously tinted and colored, gives the specific pattern to the spider from its diversified distribution; and when such clothing is absent, the pattern is often equally distinct and varied, arising in such cases from a pigment in the coats of the integument itself.

INTERNAL ORGANIZATION.—The *Muscular System* of spiders is very similar to that of the rest of the Araculata. The muscles are formed of numerous parallel fibres traversed by very marked striæ; these muscles are attached to the different portions of the tegumentary system, and move the various parts of the body by the contraction of their fibres. Those which set in motion the falces, the maxillæ, and the coxæ of the legs, are attached to the thorax, and radiate to all these parts from a centre, marked externally by what has been before spoken of as the *thoracic indentation*, or *fovea*. The other joints of the legs move, one after the other, by means of small and exceedingly fine muscles, of the two kinds ordinarily known as *extensors*, to raise the joint, and *flexors*, to lower it. All these muscles act with rapidity, and enable the legs to move in every direction according to the mode in which the various joints are articulated. The differences in the relative strength and volume of the muscles are very great; those, for instance, by which the fangs of the falces are moved are exceedingly powerful; the abdomen being generally soft, its integument does not furnish such firm points of attachment as that of the thoracic region, and yet the spider can move its abdomen with the greatest ease in every direction. Beneath the integument, at the fore part of the under side, two ligaments are attached to a membranous plate, situated under the branchiæ operculum, and at the hinder part, round the ring which encircles the spinners and the anus. The fore half of these ligaments is cartilaginous, while the hinder half is composed of contractile muscular fibres, and by means of those muscles the spider moves its abdomen. Two other pairs of muscles may also be particularly mentioned,—one pair inserted under the membrane in the junctional pedicle, the other leading round the respiratory organs: the office of these is to open or close the branchial opercula, and to draw the sexual organs backwards or forwards. The spinners are moved by special muscles similar to those of the legs.

Before concluding our remarks on the internal structure of the Araneidea, two of their special properties must be shortly noticed—the secretion of the poison injected into the wounds made by the fangs of the falces, and the secretion of the matter emitted as silken threads through the spinning organs.

The *poison* is secreted in two small elongated sacs (one for each of the falces) situated within the cephalo-thorax on either side of the alimentary canal; the sacs are connected with a membranous channel in each of the falces, the channel running completely through the fang, from an orifice near the end of which the poison is pressed out by the spider in the act of wounding its prey.

The *external spinning organs* have been mentioned above; they are usually called *spinners*, and are various in size, both actual and relative, in form and in structure, as well as in number. From the extremity of each

of these organs the silk matter issues through numerous movable papilla, or *spinnerets*, which are similar to hollow bristles with enlarged bases; the papillæ vary both in form and number in different species, and from each spinneret or papilla issues an exceedingly fine thread; this, uniting with threads from all the other papillæ, forms the ordinary silk line, which though to ordinary observation simple, is composed of numberless threads from some one, or all, of the spinners. The matter from which the silk is formed is secreted in organs (silk-glands) situated within the ventral surface of the hinder part of the abdomen. These glands vary in number, size, and form in different species; they differ also in size and shape in the same species, for the secretion of different qualities of silk-matter; and each gland has a distinct duct terminating at the extremity of the spinners. The emission of silk matter appears certainly to be a voluntary act on the part of the spider; but it is a disputed question among arachnologists, whether spiders have the power to forcibly expel it, or whether it is merely drawn from the spinnerets by some external force or other.

The white flake-like flocculi often seen floating in the air on a calm autumnal afternoon are composed of spider silk emitted by numerous immature spiders, of many species and genera, passing through the air on their knees, which, being so much lighter than the atmosphere, serve to bear them away with every breath of wind. The flocculi appear to be agglomerations of fine lines, adhesive from their fineness and fibrous nature. In this respect they differ from the ordinary gossamer lines, which are merely the threads left by small and immature spiders (chiefly of one or two families) as they pass from blade to blade and plant to plant. It seems probable that nearly all spiders leave a line or lines, which proceed from one or more of their spinners, whenever and wherever they move about; and the setting in of fine weather being the signal for a spontaneous restlessness, we can hence better understand the almost sudden appearance of myriads of lines stretching over the surface of the earth, and often extending high up into the air. Numerous papers have been written on gossamer, chiefly by German and French writers, with the latter of whom the subject has been sometimes treated on the basis of the marvellous and superstitious. These lines are called by them *fil de la Vierge*.

The geometric spiders (*Orbitalariæ*) are almost the only ones whose method of forming a snare have been at all minutely recorded. When the situation for the snare has been chosen, the area intended to be filled up by it is enclosed by various circumferential boundary lines, fixed to adjacent objects, the exact shape of the area being influenced by the situation and surrounding circumstances. A diagonal thread is then spun across it, and from about a central point of this thread another is carried to the marginal line; returning to the central point along the line just spun from it, the spider carries another line to the margin, and fixes it at a short distance from the first. In this way the whole area is gradually filled up, the spider always returning to the centre along the last line spun, and starting again thence fixes a fresh one to the boundary line of the snare. The form of the snare is now that of a wheel; the next operation is to cross the radii of the wheel with ladder-like lines; this the spider does, beginning from the centre and working towards the circumference, with a single spiral line, which is fixed, or glued, with a minute portion of viscid matter, to each of the radii as it crosses by an application of the spinners; at some distance from the centre this spiral line is discontinued and another is begun; this is formed of quite a different kind

of silk matter, being viscid, and retaining its viscosity in the form of "minute dew-like globules closely studing the line." It appears that when the viscid lines, intended for the capture of its prey, are completed, the spider cuts away the first, or unadhesive line, which is of no service in the entanglement of insects, its office appearing to be chiefly to strengthen the snare while the viscid line is being spun, and to enable the spider to traverse the parts with greater ease. Modifications of the above method are, no doubt, adopted by some species, but, substantially, it is believed that most orbicular snares are thus constructed.

GENERAL REMARKS.—Spiders are to be found more or less abundantly in every part of the world and in almost every conceivable position; even subterranean caves, such as those of Adelsberg and the Island of Lesina, are tenanted by species peculiarly adapted by the absence of eyes to their dark and gloomy abodes. Less repulsive and forbidding in appearance than most others of the Arachnida, the Araneidea are often extremely interesting in their habits. Being almost exclusively feeders on the insect tribes, they are consequently endowed with proportionate craftiness and skill; this is shown remarkably in the construction of their snares and dwellings. The "trapdoor spider" has always been one of note in popular works on spiders' habits, and certainly the details of several different types of the trapdoor tubular nest with the habits of the several species to which they belong, lately published by Mr. Traherne Moggridge, are of the greatest interest and importance. The typical trapdoor nest is a cylindrical hole in the earth excavated by the spider itself, lined with silk and closed by a lid, which fits like a valve or cork into the opening at the surface and opening by a strong elastic silken hinge, the spring of which closes it again with some slight force. Many spiders, however, live a vagabond life, and capture their prey without the aid of a snare, by springing on it unawares, or, in some cases, running it fairly down in open view; yet craft and skill are equally apparent, whatever be their mode of life and subsistence.

To say that spiders are less repulsive and forbidding in appearance than other Arachnids, is to do them but scanty justice, for numbers of species of various genera—notably among the Salticids, or jumping spiders—are unsurpassed by insects of any order, in respect both to brilliancy of coloring and the designs formed by its distribution. Some of the curious and delicate little species of the genera *Argyrodes* and *Ariamnes* are perfect marvels of metallic brilliancy and beauty. These little spiders are found living as quasi parasites, in the outskirts of the webs of the larger exotic epirids, and appear to live on the smaller insects caught in them; probably also spinning irregular snares of their own among the lines of the larger snare. In external appearance the young of spiders do not differ greatly from the adults, except in being generally more distinct in color and marking; in some species the characteristic markings can seldom be traced except in immature examples. The cocoons or nests in which some spiders deposit their eggs are very beautiful, as well as varied and characteristic in form; that of *Ero variegata* (Bl.), a little spider not uncommon in England, would arrest the attention of even an indifferent person; it is of an elegant pear shape, formed of a yellow-brown silk network, and attached by a long elastic stem, of the same material, to stalks of dead grass, sticks, or other substances, in shady places. Another, made by a larger spider, *Agroeca brunnea* (Bl.), is of a truncated pear shape, formed of a continuous white silk fabric, and attached to blades and stalks of living grass and rushes, by a short pedicle; it must, however, be seen soon after it is made, for the

maker, as if prescient of the attraction of such a beautiful little object, hastens to daub it over thickly with a coat of mud or clay, which completely conceals its structure and beauty.

Spiders vary greatly in their relative fertility; probably many species are rare owing to a limited fecundity. The egg sac of *Agroëa brunnea* (Bl.) contains about forty or fifty eggs, that of *Xysticus clavatus* (Walck.) about twenty, that of *Ero variegata* (Bl.) not so many, while that of *Oonops pulcher* (Templ.) contains usually no more than two. Some spiders, however, perhaps most, construct more than one cocoon.

From their mode of life spiders attain (as we should naturally suppose) their largest size, and are found in their greatest profusion, in the tropical regions; while in more temperate climates, where the members of the insect tribe are smaller and their species fewer, we find spiders in general of comparatively smaller dimensions and less numerous in species. One of the largest known spiders, *Eurypelma Klugii* (Koch),—Fam. Theraphosids—found in Brazil, measures upwards of two and a half inches in length, with legs nine inches and upwards in span; while the smallest known spider, *Walckenaëra diceros* (Cambr.), found in England, is but $\frac{3}{40}$ th of an inch in length. Tropical countries, however, although some of their spiders are giants, have numbers of small size. Numerous species have been procured from Ceylon measuring no more than from $\frac{1}{12}$ th to $\frac{1}{20}$ th of an inch in length.

Spiders, besides being skilful and crafty, are very cleanly; one of our common Salticæ, *Epilema histriónica* (Koch), may often be seen brushing and cleaning its forehead and eyes with its hairy palpi, as a cat uses its paws for a similar purpose. Probably most spiders, like the Crustacea, have the faculty of reproducing a lost limb. Instances of this are numerous, but a reproduced limb is seldom or never equal to the original one in size; this accounts for the frequency of examples captured with one or more legs, or a palpus, of dwarfed and stunted dimensions. Many spiders show great attachment to their eggs and young. The female *Lycosa* will seize her egg sac again and again if it be taken from her, only relinquishing it at last when apparently convinced of the hopelessness of retaining it. A pretty little spider, not rare among weeds and garden plants, *Theiridion carolinum* (Walck.), carries its egg cocoon within its legs, and searches for it anxiously if compelled to drop it. Many also of the genus *Clubiona*, as well as others brood over their eggs and tend upon their young until they disperse to find their own means of subsistence. The food of very young spiders is probably wholly derived from the moisture of the atmosphere. Spiders are great drinkers, and suffer severely from drought.

In speaking of the better qualities of spiders, their attachment to their young, and the frequent fondness for each other evidenced by the apparently happy life of the male and female of some species in the same web, we must not overlook the other side of the picture. It has been well authenticated that in some species of Epeirides the female will seize and devour the male even immediately after the exercise of his natural office, which indeed he has to undertake with great circumspection and care to be able to accomplish at all. From this propensity of the female, we may account for the gradual lessening in size of some male spiders in comparison with that of the females, by a kind of sexual selection, since it is obvious that the smaller the male the better his chance of escape.

The voracity of spiders is well known, and the propensity above noticed of the female to devour the male is but one instance of general voracity; but though

thus voracious, spiders can endure extreme fasting with impunity. A small spider enclosed in a glazed case, lived and appeared healthy for eighteen months without food; if it had any nourishment at all during this time, it could only have been the very slight moisture that might exude from the skin of a lately stuffed bird in the case, *Zoologist*, 1853, p. 3766. Other instances are also on record of fasts, almost or quite as long, and borne equally well.

ARAD, OLD, a city of Hungary, in the county of Arad, situated on the Maros, 145 miles S.E. of Pesth.

ARAFAT, or ORPHAT, a mountain near Mecca, a visit to which constitutes a necessary part of the great Mahometan pilgrimage.

ARAGO, FRANÇOIS JEAN DOMINIQUE, one of the most popular physicists belonging to the first half of the present century, was born on the 26th February 1786, at Estagel, a small village near Perpignan, in the department of the Eastern Pyrenees. His father was licentiate in law, and, being appointed treasurer of the mint for the department, removed with his family to Perpignan about the beginning of the century. Arago has left an autobiographical sketch, drawn with great vivacity, though touched occasionally with somewhat high coloring; and to this we are indebted for the incidents of the earlier portion of his life. From boyhood he had decided military tastes, inspired by constant contact with troops at his native village, which was a halting station for soldiers on their way to Perpignan, or to the army of the Pyrenees. François was sent as an outdoor pupil to the municipal college of Perpignan, and began to study mathematics with an eye to the entrance examination to the Polytechnic school. Here he was soon beyond the depth of his master's knowledge; but, with that undaunted spirit which carried him through many hardships and difficulties in after life, he sent to Paris for the works of Legendre, Lacroix, and Garnier, and studied them assiduously in private. Within two years and a half he had mastered all the subjects prescribed for examination, and a great deal more. Towards the close of 1803 he entered the Polytechnic school, with the artillery service as the aim of his ambition. In 1804, through the advice and recommendation of Poisson, with whom he had become very intimate, Arago received the appointment of secretary to the Observatory at Paris, a valuable post for a young man of science, as it brought him in contact with the most eminent philosophers of the day. He now became acquainted with Laplace, and he had as fellow-worker in the laboratory the celebrated Biot. Through the influence of Laplace with the Government, Arago and Biot were commissioned to complete the meridional measurements which had been begun by Delambre, and interrupted since the death of Méchain in 1804. The object of this survey was to determine, with as great nicety as possible, the ten-millionth part of a quadrant of the meridian through Paris, which had been agreed upon by the National Convention as the standard unit of length, and named the *mètre*. To measure an actual quadrant from the north pole was, of course, an impossibility; but the plan adopted was to measure the arc of the meridian from Dunkirk to Barcelona, and from their known difference of latitude to deduce the length of the quadrant. For this purpose they left Paris in 1806, to commence operations among the mountains of Spain—operations attended with the greatest personal privation, fatigue, and danger. Biot returned to Paris after they had determined the latitude of Formentera, the southernmost point to which they were to carry the survey, leaving Arago to make the geodetical connection of Majorca with Ivica and Formentera.

The adventures and difficulties of the latter were now

only beginning. The political ferment caused by the entrance of the French into Spain extended to these islands, and the ignorant populace began to suspect that Arago's movements and his blazing fires on the top of Mount Galatzo were telegraphic signals to the invading army. They became ultimately so infuriated that he was obliged to cause himself to be incarcerated in the fortress of Belver, in June 1808. On the 28th July he managed to escape from the island in a fishing boat, and after an adventurous voyage he reached Algiers on the 3d August. Under the disguise of a strolling merchant he procured a passage in a vessel bound for Marseilles. A journey, however, of eleven months was before him ere he was destined to reach that port, for the vessel fell into the hands of a Spanish corsair on the 16th August, just as it was nearing Marseilles. With the rest of the crew, Arago was taken to Rosas, and imprisoned first in a windmill, and afterwards in the fortress of that seaport, until the town fell into the hands of the French, when the prisoners were transferred to Palamos. After fully three months' imprisonment they were released on the demand of the Dey of Algiers, and again set sail for Marseilles, on the 28th Nov., but when within sight of their port they were driven back by a southerly wind to Bougia on the coast of Africa. Transport to Algiers by sea from this port would have occasioned a weary stay of three months; and with his usual courage, Arago set out for it by land under conduct of a Mahometan priest, reaching it on Christmas day, after encountering many perils from lions, and having uncomfortable squabbles with natives on the way. A six months' stay in Algiers gave him opportunity to note the manners and habits of the people, of which he gives some amusing and graphic accounts. Once again, 21st June 1809, he set sail for his native land; and, as by some strange perversity of fortune, he had to undergo a monotonous and inhospitable quarantine in the Lazaretto at Marseilles before his difficulties were over. The first letter he received while in the Lazaretto, was from Humboldt, at Paris, sympathising with him, and congratulating him on the termination of his laborious and perilous enterprise; and this was the origin of a connection which, in Arago's words, "lasted over forty years without a single cloud ever having troubled it."

Through all the vicissitudes of this long campaign Arago had succeeded in preserving the records of his survey; and his first act on his return home was to deposit them in the Bureau de Longitude at Paris. As a reward for his adventurous conduct in the cause of science, he was shortly afterwards (17th of Sept. 1809) voted a member of the Academy of Sciences, in room of the deceased Lalande, at the remarkably early age of twenty-three, being, to the vexation of Laplace, elected by a large majority of votes over his friend Poisson. Before the close of the same year (1809) Arago was chosen by the council of the Polytechnic school to succeed M. Monge in the chair of analytical geometry; and about the same time he was named by the emperor one of the astronomers of the Royal Observatory, which was accordingly his residence till his death. He was also made one of the examiners in connection with the *École d'Application* for engineers and artillery at Metz. In all these situations he rapidly attained very great popularity, gaining the esteem of his pupils by the charming clearness of his style in lecturing and the personal interest he showed in their progress.

In 1816, along with Gay-Lussac, Arago commenced a monthly journal of science, the *Annales de Chimie et de Physique*, which soon acquired that high scientific reputation which it has always maintained. In the same year the two philosophers visited England and made the personal acquaintance of some of the most

eminent men in that country, meeting among others Dr. Thomas Young, a memoir of whom was afterwards written by Arago. In 1818 or 1819, Arago proceeded along with Biot to execute, on the coasts of France, England, and Scotland, the geodetic operations which the Board of Longitude had directed. They also measured the length of the seconds' pendulum at Leith, and in Unst, one of the Shetland isles; the results of the observations being published in 1821, along with those made in Spain. He was elected a member of the Board of Longitude immediately afterwards, and proved a valuable addition to the society, contributing to each of its *Annals*, for about twenty-two years, most important scientific notices on astronomy and meteorology, and occasionally on civil engineering, as well as interesting memoirs of members of the Academy.

After his appointment to the Observatory, Arago had commenced, at the request of the Board of Longitude, a series of popular lectures on astronomy, which were continued from 1812 to 1845. His success as a lecturer was almost unparalleled, and can only be compared to that of Faraday. All ranks flocked to hear him fascinated by his graceful eloquence and his crystalline clearness of explanation. He used to remark, what many lecturers often forget, that "*clearness is politeness in public speakers*." His manner in lecturing is said to have been to fix his eye on some one of his audience, whose intellect had apparently the minimum of development, and to keep it fixed till the face should brighten up with intelligence.

When Buonaparte's hopes of empire in Europe had begun to wane, and he was turning to America as a land of refuge, where he might still have scope for his ambition, he suggested to M. Monge that, with a scientific guide, he should explore the new continent from Canada to Cape Horn, study the great physical wonders of that territory, and leave behind him works and discoveries worthy of himself. Monge named Arago as the proper associate and assistant in the enterprise, and had even negotiated with Napoleon for a handsome allowance to be granted to Arago, and for a fund to be devoted to the purchase of a complete set of astronomical and physical instruments. But Arago would not for a moment entertain the proposal. He pointed the emperor to the march of the English and Prussian armies on his capital as a matter demanding more pressing consideration, and declined to leave the Old World to study science in the New, "when France might perhaps lose its independence and disappear from the map of Europe." Subsequent events prevented a renewal of Napoleon's scientific negotiations and projects.

After the Restoration Arago took no very prominent part in the politics of the day, though he at all times maintained with boldness and ardent liberal opinions of the extreme republican type. By the revolution of 1830, however, he was summoned from the studies of the observatory and the laboratory to the field of political strife in the Chamber of Deputies, and in the Municipal Council of Paris. Elected a member of the Chamber of Deputies for the Lower Seine, he employed his splendid gifts of eloquence and scientific knowledge in all questions connected with public education, the rewards of inventors, and the encouragement of the mechanical and practical sciences. Many of the most creditable national enterprises, dating from this period, are due to the advocacy of Arago—such as the reward to Daguerre for his wonderful invention of photography, the grant for the publication of the works of Fermat and Laplace, the acquisition of the museum of Cluny (one of the sights of Paris), the development of railroads and electric telegraphs, the improvement of the navigation of the Seine, and the boring of the Artesian wells at Grenelle.

The year 1830 was a remarkable epoch in his life on account of several other offices to which he was appointed. He now received the chief direction of the Observatory, and from his position in the Chamber of Deputies he obtained grants of money for the rebuilding of part of the Observatory and for the addition of magnificent instruments, which raised it to be a model, in place of a public disgrace, as it had been before. In the same year, too, his zeal in the cause of science was rewarded with the highest honor any philosopher might aspire to—the perpetual secretaryship of the Academy of Sciences, in room of the distinguished Fourier. On the 7th June (1830) he was elected by 39 out of 44 votes. This appointment inspired new life into the Academy. Arago threw his whole soul into its service, and by his pleasing faculty of securing friendship and life-long attachments, he gained at once for himself and for the Academy a world-wide reputation. As perpetual secretary it fell to him to pronounce historical *éloges* on the decease of resident or foreign members of the Academy; and for this duty his rapidity and facility of thought, his happy piquancy of style, and his extensive knowledge peculiarly adapted him. Some of his *éloges* are masterpieces of elegant biography. When M. Flourens pronounced Arago's own funeral eulogy, he said, "In the eulogies of the eloquent secretary are found all the qualities of his spirit, *d'une verve brillante, de la vigueur, de l'élan, un certain charme de bonhomie.*"

In 1834 Arago visited England for the second time, to attend the third meeting of the British Association, held that year in Edinburgh. From this time till the stirring events of 1848, Arago led a life of comparative quiet,—not the quiet of inactivity, however, for his incessant labors within the Academy and the Observatory produced a multitude of contributions to all departments of physical science, which make him one of the most voluminous of authors in this subject. But the change came. Louis Philippe, having failed to satisfy the extreme republican party, and to grant them those social advantages that they imagined a republic alone could yield, was swept from his throne, and Arago left his laboratory to join in forming an extempore government. His popularity was so great that he was entrusted with the discharge of two most important functions, that had never before been united in one person, viz., the Ministry of War and of Marine. Energetically and faithfully the philosopher of forty years' standing applied himself to his new duties; and however ignominious may have been the ultimate failure of the Provisional Government, there can be little question that Arago struggled honestly in the cause of social liberty and improvement. While Minister of Marine he effected some salutary reforms, such as the improvement of rations in the navy and the abolition of flogging; he abolished political oaths of all kinds, and, against an array of moneyed interests, he succeeded in procuring the abolition of negro slavery in the colonies.

During the insurrection of June, Arago's courage was conspicuously displayed in his entreaties to the mob to stop their murderous outrages. For the first time in his life Arago failed, and he himself narrowly escaped with his life. With his mental and physical energies shattered by fatigue and disappointment, he terminated here his active political career, though he continued to the last to take an interest in the affairs of his country, and to watch for the dawn of a brighter future. Failing eye and trembling hand could now be of little use in the service of science; but warned by the disease (diabetes) that had attacked him, he determined to occupy his few remaining years in preparing for the press some MSS. of original researches which his political duties had prevented his communicating to the Institute.

In the beginning of May 1852 proclamation was made that the oath of allegiance to the Government of Louis Napoleon would be required from all its functionaries, including the Board of Longitude. Arago peremptorily refused, choosing to sacrifice his office and home of nearly half a century rather than violate the dictates of his conscience, which he would be doing if he complied, seeing that, as a member of the Provisional Government of 1848, he contributed to the abolition of all political oaths. In a letter to the Minister of Public Instruction, he intimated his resignation of his post as astronomer at the Bureau de Longitude, at the same time stating the services he had rendered to his country in the cause of science, and the grief which this separation from the scene of his labors of so many years would impose. To the credit of the Prince President, he respected the sentiments so boldly declared by the half-blind old philosopher, and made "an exception in favor of a servant whose works had thrown lustre on France, and whose existence his Government would regret to embitter."

The tenure of office thus granted did not prove of long duration. Arago was now on his death-bed, under a complication of diseases, induced, no doubt by the hardships and labors of his earlier years. In the summer of 1853 he was advised by his physicians to try the effect of his native air, and he accordingly set out for the Eastern Pyrenees, accompanied by his affectionate niece, Madame Langier. But the change was unavailing, and he returned to Paris to die. After a lingering illness, in which he suffered first from diabetes, then from Bright's disease, and lastly from dropsy, he breathed his last on the 2d Oct. 1853, at the age of 67. The day before his death he had been visited by Lord Brougham, his old and intimate friend, and the interview had excited him much. M. Biot also had an interview with him only three hours before his death. Arago said to his veteran colleague and *collaborateur*, "I intend to resign my situation of perpetual secretary to the Academy, since I can no longer discharge its duties." Biot's reply must have smoothed the pillow of the dying savant, "If you do, we will all come to you in a body to bring it back to you, and reproach you for your ingratitude."

ARAGO, ETIENNE, a brother of the astronomer, was born at Estagel, France, February 9, 1802, and at the age of twenty-two began to produce a long series of successful comedies and vaudevilles. He took part on the popular side in the fighting in Paris in 1830, founded the *Reforme*, a democratic newspaper, and from February to December, 1848, was director-general of the postoffice under the Second Republic. Hevoted with the left and opposed the ambitious schemes of Louis Napoleon, by whom he was banished in 1849. Ten years later he returned, and in 1879 served as mayor of Paris. In 1871 he was returned to the National Assembly, but soon resigned. In 1878 he was appointed archivist to the *Ecole des Beaux-Arts*.

ARAGO, FRANCOIS VICTOR EMMANUEL, son of the great savant, was born in Paris in 1812, studied law and defended political prisoners under Louis Philippe. He took an active part in the Revolution of February, 1848, and became a member of the Constituent Assembly, and in May, 1849, minister to Berlin. He resigned and withdrew from public life during the empire, in 1869 became a member of the Legislative Assembly, and in 1870 a member of the government.

ARAGO, JACQUES ETIENNE VICTOR, brother of the astronomer, was born March 10, 1790. In 1817 he made a trip around the world, and afterward settled first at Bordeaux and then at Toulouse, where he wrote plays, poems and romances. In 1835-37 he managed a theatre at Rouen and in 1849, although affected with

blindness, he led an expedition to California in search of gold. Among his published works the best known are his *Voyage Around the World* (1822), and *History of a Busy Life* (1853). He died in Brazil in January, 1855.

ARAGON, a captaincy general, or, as it is usually called by the Spaniards, a kingdom, of Spain, is bounded on the north by the Pyrenees, which separate it from France, east by Catalonia and Valencia, south by Valencia, and west by Navarre and the two Castiles. It has an area of 14,726 English square miles, and a population of 945,960—calculated for 1890 on the basis of the census of 1881. It is divided by the river Ebro, which flows through it in a south-easterly direction, into two nearly equal parts, known as *Trans-ibero* and *Cis-ibero*. The north is occupied by a portion of the Pyrenees, which here attain in Monte Perdido, or as it is variously called Mont Perdu, Las Tres Sorores, almost their highest altitude (11,430 feet); and in the south and west are various sierras of considerable elevation. The whole surface, indeed, is very irregular. The large and fertile plain in the middle, bordering on the Ebro, is broken by offshoots from the north and south, while the mountain ranges, on the other hand, are interrupted by numerous valleys of great beauty. The central pass for carriages over the Pyrenees is on the line between Saragossa and Pau, and bears the name of Port de Confranc. The Ebro is the principal river, and receives from the north in its passage through the province, the Arba, the Gallego, and the united waters of the Cinca, the Essera, the Noguera Ribagorzana, and the Noguera Pallaresa—the last two belonging to Catalonia; and from the south the Xalon and Xiloca and the Guadalupe. The Imperial Canal of Aragon, which was commenced by Charles V. in 1529, but remained unfinished for nearly two hundred years, extends from Tudela almost to Sastago, a distance of 80 miles; it has a depth of 9 feet, and an average breadth of 69, and is navigable for vessels of about 80 tons' burthen. The Royal Canal of Tauste, which lies along the north side of the Ebro, was cut for purposes of irrigation, and give fertility to the district. Two leagues N.N.E. of Albarracin is the remarkable fountain called Cella, 3700 feet above the sea, which forms the source of the Xiloca; and between this river and the Sierra Molina is an extensive lake called Gallicant, covering about 6000 acres. The climate of Aragon is, as might be supposed, of a very varied character, rigorous in the north and among the sierras, but mild and even oppressive in the south, especially towards the Mediterranean. Its vegetable products are necessarily affected by a similar variety. The hills are clothed in many places with oak, pine, and beech, which, if utilised, would furnish a good supply of timber. The flora is exceedingly rich, but has been slightly explored. Wheat, maize, rice, wine, oil, flax, and hemp, of fine quality, are grown in considerable quantities; as well as saffron, madder, liquorice, sumach, and a variety of fruits. Swine and sheep are reared in considerable numbers, the merino wool supplied by the latter being one of the chief productions of the province; but little attention is paid to other descriptions of cattle. The manufactures are comparatively insignificant, being in a great measure supplementary to the agricultural and pastoral pursuits of the people. The silk manufacture has declined, and woollen and linen cloth is only produced in small quantities. The mineral resources of the country consist of iron, lead, copper, sulphur, cobalt, asphalt, lignite, alum, rocksalt, jet, marble, and jasper, which are all found in abundance, but they are very inadequately wrought. Aragon is divided into three provinces, HUESCA, TERUEL, and SARAGOSSA, ac-

counts of which will be found under these headings. The capital is Saragossa, and the other towns of importance are Jaca, Huesca, and Barbastro to the north of the Ebro, and Tarazona, Calatayud, Daroca, Calamocha, Albarracin, Montalban, Teruel and Alcañiz to the south. Saragossa is an archbishopric, and Huesca, Tarazona, Barbastro, Jaca, Teruel, and Albarracin are episcopal sees.

ARAGONA, a town in Sicily, 7½ miles N.N.W. of Girgenti. Population, 9,571.

ARAGUAYA, or ARAGUAIA, a river of Brazil which rises in the Sierra Sciada, and flows north between the provinces of Matto Grosso and Goyaz till it joins the Tocantins at San João das duas Barras. It divides into two branches, and unites again, thus forming the large island of Santa Anna or Bannanal. The eastern branch, called the Furo, is the one principally navigated. The most important tributaries are the Cristalino, the das Mortes, and the Caja, on the west, and the Claro, the Vermelho, the Cruzas, and the Chavantes, from the east. The whole course of the river is about 1,000 miles, and it is navigable a long way up.

ARAHAL, a town in Spain, 7 miles from Seville.

ARAKÁN, a division of British Burmah, and within the jurisdiction of the chief commissioner of that province. It consists of a strip of country running along the eastern seaboard of the Bay of Bengal, from the Naf estuary, on the borders of Chittagong, to Cape Negrais. Area, 14,526 sq. m. Population, 587,513.

ARAL, a vast lake or inland sea, in the west of Asia. It was known to the Persian geographers as the Sea of Khwārizm or Khwarezm, from the neighboring district of the Chorasmii, and derives its present name from the Kirghese designation of *Aral Denghis*, or Sea of Islands. Its length, from north to south, is 265 miles, and its breadth, from east to west, about 145. It is the greatest body of water in the steppes of Asia, next to the Caspian Sea, and is one of the largest lakes in the world. Its level is 117 (or, according to recent explorations, which, however, require verification, 250) feet above the Caspian, which is 84 feet above the Black Sea. It is bounded on the N. by the Ural steppes; on the W. by the rocky plateau of the Ust-Urt, which separates it from the Caspian; on the S. by the alluvial district of Khiva; and on the E. by the Kysyl-Kum, or Red Desert, and the Kara-Kum, or Black Desert. The sea abounds with fish of various kinds, as the sturgeon, silurus, carp, and especially a species of herring; thus agreeing in its ichthyology with the Caspian, from which it is distant 150 miles. The water is only slightly brackish. During winter the northern portion is completely frozen, but towards the south it is very seldom that ice is formed to any extent. The Aral has no visible outlet; and to account for there being no visible increase in its size, it was supposed that there might be a subterranean communication with the Caspian Sea or the Sea of Khuzar; but the evaporation is so great as not only to maintain an equilibrium, but even, it has been thought, to produce, as in the case of the Caspian, a gradual diminution.

ARAM, EUGENE, was born of humble parents at Ramsgill in Yorkshire, in 1704. He received little education at school, but manifested an intense desire for learning. While still young, he married and settled as a schoolmaster at Netherdale, and during the years he spent there, he taught himself both Latin and Greek. In 1734 he removed to Knaresborough, where he remained as schoolmaster till 1745. In that year a man named Daniel Clark, an intimate friend of Aram, after obtaining a considerable quantity of goods from some of the tradesmen in the town, suddenly disappeared. Suspicions of being concerned in this swindling transac-

tion fell upon Aram. His garden was searched, and some of the goods found there. As, however, there was not evidence sufficient to convict him, he was discharged, and soon after set out for London, leaving his wife behind. For several years he traveled through parts of England, acting as usher in a number of schools, and settled finally at Lynn, in Norfolk. During his travels he had amassed considerable materials for a work he had projected on etymology, to be entitled, a *Comparative Lexicon of the English, Latin, Greek, Hebrew, and Celtic Languages*. In February 1759 a skeleton was dug up at Knaresborough, and some suspicion arose that it might be Clark's. Aram's wife had more than once hinted that her husband and a man named Houseman knew the secret of Clark's disappearance. Houseman was at once arrested and confronted with the bones that had been found. He affirmed his innocence, and, taking up one of the bones, said, "This is no more Dan Clark's bone than it is mine." His manner in saying this roused suspicion that he knew more of Clark's disappearance than he was willing to admit. He was again examined, and confessed that he had been present at the murder of Clark by Aram and another man, Terry, of whom nothing further is heard. He also gave information as to the place where the body had been buried in St. Robert's Cave, a well-known spot near Knaresborough. A skeleton was dug up here, and Aram was immediately arrested, and sent to York for trial. Houseman was admitted as evidence against him. Aram conducted his own defence, and did not attempt to overthrow Houseman's evidence, although there were some discrepancies in that; but made a skillful attack on the fallibility of circumstantial evidence in general, and particularly of evidence drawn from the discovery of bones. He brought forward several instances where bones had been found in caves, and tried to show that the bones found in St. Robert's Cave were probably those of some hermit who had taken up his abode there. He was found guilty, and condemned to be executed on the 6th August, three days after his trial. While in his cell he confessed his guilt, and threw some light on the motives for his crime, by asserting that he had discovered a criminal intimacy between Clark and his own wife. On the night before the 6th August he attempted to commit suicide by opening the veins in his arm; but he was discovered before life was extinct, and suffered the last penalty of the law. The story of Eugene Aram has been made the subject of a powerful ballad by Hood, *The Dream of Eugene Aram, the Murderer*, and of a romance by Bulwer Lytton, entitled *Eugene Aram*.

ARAMAIC LANGUAGES are so called from *Aram*, a geographical term, which in old Semitic usage designates nearly the same districts as the Greek word Syria. Aram, however, does not include Palestine, while it comprehends Mesopotamia (*Heb.* Aram of two rivers), a region which the Greeks frequently distinguish from Syria proper. Thus Aramaic languages may be geographically defined as the Semitic dialects originally current in Mesopotamia and the regions extending S.W. from the Euphrates to Palestine. Philologically these dialects form a distinct group of Semitic languages (North Semitic), separated by grammatical and lexical peculiarities alike from the middle Semitic (Hebrew, Phœnician) and from the South Semitic (Arabic, Ethiopic). Babylonia is not part of Aram, and the Semitic language of the Assyrian and Babylonian arrowhead inscriptions is not Aramaic.

All Aramaic dialects are characterized by poverty of vowels, by the disappearance of many of the forms of internal declension so characteristic of the original genius of Semitic speech, and by a tendency to analytical

construction by the aid of relative particles in place of the earlier usage of the construct state. Along with these marks of degradation they retain some antique features lost in Hebrew and Arabic, and in particular, generally present the oldest consonantal forms, having mutes instead of sibilants and aspirates, in a way quite analogous to the relation of Low to High Dutch. A special Aramaic peculiarity is the enclitic use of the article as in modern Danish.

The tribes of ancient Aram never possessed political unity, their settlements being intersected by strips of desert with Arabian population. Thus, there must have been from an early time considerable diversity of dialect within the group, and apart from differences due to the very various ages of the extant literature, we are able to divide Aramaic into two main branches, commonly known as Chaldee and Syriac respectively, and distinguished partly by differences of pronunciation and vocabulary, but more conclusively by differences of grammatical flexion, especially in the verb. In comparison with the great age of this branch of Semitic, the whole Aramaic literature is of comparatively late date, and presents the languages in an advanced and in some sense exhausted stage of development.

ARAN ISLANDS, SOUTH, three islands of carboniferous limestone, which lie across Galway Bay, on the west coast of Ireland, in a south-easterly direction, forming a kind of natural breakwater. They are called respectively—beginning with the most northern—Inishmore (or Aranmore), the Great Island; Inishmaan, the Middle Island; and Inisheer, the Eastern Island.

ARANDA, PEDRO PABLO ABARCA Y BOLEA, Count of, a descendant of a noble family in Aragon, was born at Saragossa, 21st Sept. 1718. He served for several years in the army, and, after retiring with the rank of lieutenant-colonel, spent some time in travelling through France, Italy, and Prussia. He seems to have fallen under the displeasure of Ferdinand VI., but on the accession of Charles III. in 1759, he was appointed ambassador to the court of Poland, an office which he held for several years. On his return he took command of the army sent against the Portuguese, and gained some success. He was then appointed captain-general of Valencia, from which place, two years later, in 1765, he was summoned to Madrid, to assist in quelling an insurrection. His success was rewarded by the appointment to the Presidency of the Court of Castile. While holding this office he induced the king to give his consent to an order for the banishment from Spain of all the Jesuits. His further intention of abolishing the Inquisition was prematurely disclosed, and great indignation was excited against him. He was dismissed from the presidency of the council, and sent as ambassador to Paris. Here he was instrumental in bringing about peace between Spain and Britain. The presidency from which Aranda had been dismissed was held for a short time by his political adversary, Grimaldi, who was succeeded by the count of Florida Blanca. On the dismissal of the latter in 1792, Aranda was recalled to his former position, but from it he was again quickly driven by the influence of Godoy, the queen's favorite. Soon after he obtained permission to retire to his own estates, where he died in 1799.

ARANJUEZ, a town in Spain in the province of Madrid, situated 1640 feet above the sea, in a beautiful valley on the left bank of the Tagus, near its junction with the Jarama, 28 miles S.S.E. of the capital and 22 E.N.E. of Toledo, and united by rail with both, these cities.

ARARAT. This name, originally designating a whole district of Asia has long been appropriated by the uniform usage of Europeans to the lofty Armenian

mountain which stands on the confines of the Russian, Turkish, and Persian dominions, in lat. $39^{\circ} 42' N.$, long. $44^{\circ} 35' E.$, known to the Armenians as *Masis*, to the Turks as *Ak-Dagh*, and to the Persians as *Kuh-i-Nuh*, or Noah's Mountain. Whether the tradition, which makes it the resting place of the ark, is of any historical value or not, there is at least poetical fitness in the hypothesis, inasmuch as this mountain is about equally distant from the Black Sea and the Caspian, from the Mediterranean and the Persian Gulf. Another tradition — accepted alike by Christians and Mahometans — fixed on Mount Judi, in the south of Armenia, as the ark's resting-place. There so-called genuine relics of the ark were exhibited, and a monastery and mosque of commemoration were built; but the monastery was destroyed by lightning in 776 A.D., and the tradition has declined in credit. Mount Ararat is the culminating point of the Armenian plateau, which reaches at its base a height of 3000 feet. From this it rises in a graceful isolated cone (having at its side the more perfect but less lofty cone of Little Ararat) far into the region of perennial snow. It was long believed by the Armenian monks that no one was permitted to reach the "secret top" of Ararat with its sacred remains. The summit, however, has been frequently reached in the course of this century.

ARAS, the ancient *Araxes* (Turk. and Arab. *Ras*, Armen. *Ērash*, Georg. *Rashki*), a river which rises south of Erzeroum, in the Bingöl-Dagh (Mountain of the Thousand Wells), and flows east through the province of Erzeroum and Russian Armenia, passing between Mount Ararat and Erivan, till it joins the Kur (*Cyrrus*) coming from the north, and falls with it into the Caspian Sea. Its separate course is about 500 miles long, and it receives a number of tributaries, of which one of the chief is the Zenghi, which passes by Erivan and drains lake Goukcha or Sivan.

ARATUS, one of the rulers of Sicyon, was born in that city, 271 B.C. His father, Clinias, was slain by Abantidas; and Aratus, then seven years of age, only escaped a similar fate through the kindness of Soso, the sister of Abantidas, who had him conveyed secretly to Argos. At the age of twenty he regained without bloodshed his native city of Sicyon, and induced the citizens to join the Achæan League. He obtained assistance in money from Ptolemy, whom he visited, and soon after (245 B.C.) he was elected general of the League. Two years later, when again general, he took Corinth from the Macedonians, and united it to the League. About the same time he defeated the Ætolians at Pellene, and his success drew many other cities into the League, which, under the careful management of Aratus, was rapidly becoming a powerful confederation. Its power, however, roused the jealousy of Cleomenes of Sparta, and in 226 war broke out between the Spartans and Achæans. Cleomenes was victorious at Lycæum, Megalopolis, Hecatombeum, and Dyme, and completely broke the power of the League. As a last resource, Aratus entered into negotiation with Antigonus of Macedonia, and, by promising to deliver up Corinth, secured his assistance. Antigonus was made general of the League, and in 222 totally defeated Cleomenes in the battle of Sellasia. The general peace which now ensued was broken by the turbulent Ætolians, who invaded Achæa. Aratus having marched against them, suffered so severe a defeat at Caphæ that he was accused and tried for mismanagement; his former great services alone saved him from suffering the penalty of failure. Philip of Macedonia, who was then called in to the assistance of the Achæans, succeeded in establishing peace, but his ambition was roused by the hope of obtaining supremacy in Greece. The counsels of Aratus became distasteful, and Plu-

tarch does not hesitate to ascribe the death of Aratus, a few years later (213 B. C.), to poison administered by the order of his royal master. The body was conveyed to Sicyon, where a monument was erected as a memorial of his services. Aratus is one of the few great names in later Greek history. He had an intense hatred of tyrants, and devoted his whole life to the attainment of liberty for Greece. His talents as a statesman were great, but their effect was marred by his incompetence and want of success as a general.

ARATUS, a Greek poet, was born at Soli in Cilicia. The date of his birth is uncertain, but it is known he lived about 270 B.C., and as he was court-physician to Antigonus Gonatas, king of Macedonia, he must have been contemporary with several of the great Alexandrian writers, — Aristophanes of Byzantium, Aristarchus, and Theocritus.

ARAUCANIA, a territory of South America. It is bounded on the N. by the river Biobio, which separates it from Chili, S. by the Valdivia, E. by the Andes, and W. by the Pacific Ocean. See AMERICA, vol. i. p. 238, and PATAGONIA.

ARAUCARIA, a genus of Coniferous trees included under the tribe Abietinæ, and the sub-tribe Araucariæ.

ARAVALLI HILLS, a range of mountains in India, running for three hundred miles in a northeasterly direction through the Rājputān states and the British districts of Mairwārā and Ajmir. They consist of a series of ridges and peaks, with a breadth varying from 6 to 60 miles, and an elevation of 1000 to 3000 feet, the highest point being Mount Abu, rising to 5655 feet, near the southwestern extremity of the range. (See ABU.)

ARBACES, the founder of the Median empire in 876 B. C., was one of the generals of Sardanapalus, king of Assyria, and had command of the contingent from the province of Media. He conspired with Belesys, a Chaldean priest, who commanded the troops from Babylon, and having gained over several other officers of the king, they revolted. After a short contest Sardanapalus was defeated, and committed suicide. The dynasty founded by Arbaces lasted till its overthrow by Cyrus, 559 B.C. This account of the Median empire rests on the authority of Ctesias, as given in Diodorus (ii. 24, 34), and cannot be reconciled with what is stated by Herodotus, who is probably referring to another event. Arbaces, the Mede, is to be distinguished from the satrap of the same name who commanded a division of the army of Artaxerxes in his war with his brother Cyrus.

ARBELA, now Arbīl or Erbil, a small town in the province of Shehrezur, situated to the west of the Tigris, in the plain between the Greater Zab and the Lesser Zab, and on the route between Mosul (*Nineveh*) and Baghdad, about 40 miles from the former.

ARBITRAGE (derived in its turn from the primary sense of arbitrating disputes) is a term that is applied both to a calculation and to a trade: 1st, to the calculation of the relative simultaneous values at any particular moment of any particular merchandise, on one market, in terms of the quotations on one or more other markets, taking, of course, the exchanges into account; and 2d, to the business founded on such calculations, of buying (or *vice versâ*) wholesale in the cheapest market for the time being, and simultaneously reselling (or *vice versâ*) equal amounts in the dearest market, or if not simultaneously, at least as nearly simultaneously as post and telegraph will permit. Arbitrage proper is a separate, distinct, and well-defined business, with three main branches. Two of these, viz., arbitrage or arbitration in bullion and coins, and arbitration in bills, also called the arbitration of exchanges, fall within the businesses of bullion dealing and banking respectively. The third, arbitrage in stocks and shares,

is *arbitrage* properly so called, and so understood, whenever the word is mentioned without qualification among business men, and it is strictly a Stock Exchange business. A few of the great financial firms outside the Stock Exchange combine the three arbitrations; they are dealers in bullion, in bills, and in stocks and shares all over the world; but, as a rule, the *arbitrage* properly known as such, is the business of an *arbitrageur*, who is almost always a member of a Stock Exchange or "Bourse," and his arbitrations with very few exceptions are neither in bullion nor in bills, but in Government and other stocks and shares. In this strict and accurate sense, *arbitrage* may be defined to be a traffic, consisting in the purchase (or sale) on one Stock Exchange, and simultaneous or nearly simultaneous re-sale (or repurchase) on another Stock Exchange, of the same amount in the same stocks or shares, which at any moment are found, on telegraphic or other advices, to be quoted and negotiable on two or more markets at a difference in price (arising from whatever temporary cause), sufficient to cover the cost of transmission, commission, interest, insurance, and leave an adequate profit over and above to be divided by the operators at both ends.

ARBITRATION, a term derived from the nomenclature of the Roman law, and applied to an arrangement for taking, and abiding by, the judgment of a selected person in some disputed matter, instead of carrying it to the established courts of justice. Arrangements for avoiding the delay and expense of litigation, and referring a dispute to friends or neutral persons, are a natural practice, of which traces may be found in any state of society; but it is to the Justinian jurisprudence that we owe it as a system which has found its way into the practice of European nations in general, and has even evaded the dislike of the English common lawyers to the civil law. The eighth section of the fourth book of the *Pandects* is devoted to this subject. Almost all the advantages, as well as the defects of the system in modern practice, seem to have been anticipated by the Roman jurists. Some of the civilians make a distinction between the *arbitrator*, the name applicable to a person voluntarily chosen by parties to decide disputes, and the *arbitrator*, an officer to whom the *prætor* is supposed to have remitted questions of fact as to a jury. In this sense arbiters appear to have been employed as a substitute for jury trial in some of the old provincial laws of France; and hence, perhaps, it comes that, by a very remarkable provision in the French code of commerce, all questions between partners touching the partnership must be referred to arbitration. In the code of civil procedure the title *des arbitrages* is treated so fully and minutely, as very forcibly to convey the impression of a separate system of voluntary jurisdiction, being created for performing what ought to be accomplished by the ordinary tribunals in a well-regulated judicial system. In Scotland the practice of arbitration has been imported from the Roman law without requiring, as in England, statutory intervention. It is one of the advantages of the Scottish system of registration that the decree-arbitral, or decision of the *arbitrator*, when recorded in pursuance of the consent of the parties in their contract of arbitration or submission, can be enforced as the decree of a court.

ARBITRATION, in International Law, is one of the recognised modes of terminating disputes between independent nations. Vattel calls it "a reasonable and natural mode of deciding such disputes as do not directly interest the safety of a nation." Heffter mentions six cases in which the judgment of the arbitrators would not be binding on the contending parties, viz., when the agreement has been insufficient, when the

arbitrators have been incapable, when they have acted on bad faith, when the parties have not been understood, when the award is in excess of the reference, and when it is contrary to natural justice. Arbitration is sometimes spoken of as a universal substitute for war, but hitherto there has been no inclination, on the part of independent states, to submit any but secondary questions to the decision of neutral parties. The king of Prussia acted as arbitrator between England and France in 1843, in what were known as the *Portendic* claims. In the case of the "General Armstrong" privateer, between the United States and Portugal, the president of the French Republic (afterwards the Emperor Napoleon) acted as arbitrator. The most formal experiment in arbitration, however, was the Geneva Convention in 1872. The United States having for many years urged upon England the settlement of what were called the "Alabama" claims, a treaty was concluded by which the case was referred to five arbitrators named by England, the States, the Swiss Republic, the king of Italy, and the emperor of Brazil, respectively. Three new rules were at the same time drawn up for the arbitrators to follow in deciding on the liability of England. The award was in favor of America, and the English representative (Lord Chief Justice Cockburn) was the only dissident.

Arbitration is frequently employed to settle differences not of a legal character, e.g., disputes between masters and workmen as to the rate of wages, hours of labor, &c.

ARBOGA, an ancient town in Sweden, in the government of Westerbås, 30 miles S.W. of Westerbås, on a river of the same name as itself, near its junction with the canal which joins the Malar and Hielmar Lakes.

ARBOIS, a town in France, in the department of Jura, and arrondissement of Poligny, situated in a deep valley, on the Cuisance, 940 feet above the level of the sea. It has long been famous for its wines, which, as early as 1493, were exempt from taxation in Burgundy and the German empire by Maximilian I.

ARBOR VITÆ (*Tree of Life*), is a name applied to species of *Thuja* and *Biota*. The name was given by Clusius, and its origin is uncertain. The plants belong to the Coniferous order, and have been placed in the tribe *Abietinæ* and the sub-tribe *Cupressinæ* (Cypresses), in which the anthers are 3 to 5, rarely 2; scales of the cones 4 or more, usually placed opposite to each other in a decussate manner, persistent (not falling off), seeds having usually 2 to 3 wings; cotyledons 2. *Thuja* or *Thuya occidentalis* (L.), is the Western or American *Arbor Vitæ*. It is a native of North America, and ranges from Canada to the mountains of Virginia and Carolina. It is a moderate sized tree, and, in its native country, it attains a height of about 50 feet. The leaves are small and imbricate, and are borne on flattened branches, which are apt to be mistaken for the leaves. When bruised the leaves give out an aromatic odor. The resin obtained from the plant has been used as a remedy in rheumatic affections. The flowers appear early in spring, and the fruit is ripened about the end of September.

ARBORICULTURE comprises all that relates to the culture of trees, and is one of the great divisions of agriculture; it is a branch of rural economy of much more recent date than either the culture of grain and herbage plants, or the breeding and rearing of cattle. The culture of those plants which supply the food of man or nourish the domestic animals must have exclusively occupied his attention for many ages; while the timber employed in houses, ships, and machines, or for fuel, was found in the native woods. Hence, though the culture of fruit trees, and occasionally of

ornamental trees and shrubs, was practiced by the Egyptians, Greeks, and Romans, the cultivation of timber trees on a large scale only took place in modern times. In the days of Charlemagne, the greater part of France and Germany was covered with immense forests; and one of the benefits conferred on France by that prince was the rooting up of portions of these forests throughout the country, and substituting orchards or vineyards. Artificial plantations appear to have been formed in Germany sooner than in any other country, apparently as early as the 15th century. In Britain planting was begun, though sparingly, a century later. After the extensive transfers of property on the seizure of the church lands by Henry VIII., much timber was sold by the new owners, and the quantity thus thrown into the market so lowered its price, as Hollingshed informs us, that the builders of cottages, who had formerly employed willow and other cheap and common woods, now built them of the best oak. The demand for timber constantly increased, and the need of an extended surface of arable land arising at the same time, the natural forests became greatly circumscribed, till at last timber began to be imported, and the proprietors of land to think, first of protecting their native woods, afterwards of inclosing waste ground, and allowing it to become covered with self-sown seedlings, and ultimately of sowing acorns and mast in such inclosures, or of filling them with young plants collected in the woods,—a practice which exists in Sussex and other parts of England even now. Planting, however, was not general in England till the beginning of the 17th century, when the introduction of trees was facilitated by the interchange of plants by means of Botanic Gardens, which, in that century, were first established in different countries.

Trees differ from one another in regard to magnitude; slowness or rapidity of growth; suitability for particular soils, and for elevated exposed situations, or low and sheltered places; texture, color, and durability of the timber; delicacy or hardness; ease or difficulty of propagation and rearing; production of showy flowers or fruits; and in other respects. In regard to magnitude, those trees which, in America, and in the same parallels of north latitude attain the greatest height, are the spruce and hickory, the larch, and red pine; and these are also the trees which, in most parts of America, produce the greatest quantity of timber in their trunks relatively to that contained in their branches, and in the shortest time. Poplars, willows, and some species of elm, are rapidly-growing trees; their timber is rarely contained in one straight trunk, as in the case of pines, a considerable proportion being distributed among the branches. Hence, where the speedy production of timber is the main object, pines are the preferable trees for planting. Some species of willow and some poplars will grow near water in situations where their roots can enter into it, but will not grow in undrained soil. All the known species of trees and shrubs may be successfully grown in almost any kind of soil not beyond the average moisture, dryness or tenacity. In some soils, however, they thrive better than in others, and the timber produced generally varies in quality according to the soil. Thus, a rich soil, while it contributes to the rapid growth of the coniferous tribe, renders their timber less durable; and the same law holds, more or less, with every other species of tree.

The influence of climate on trees is much greater than that of soil, for, while many trees grow on any soil, every tree may be said to have its particular climate; that is, a climate in which, the soil and other

circumstances being suitable, it will produce the largest and most enduring timber. Hence, when we take the geographical range of any species, we find what may be called a central climate, where it attains its largest size; and as it recedes from this climate, by latitude or elevation, into one either colder or hotter, it gradually diminishes in size, till it at last appears in the form of a shrub. Thus, the common oak, which in America attains its largest size in the Western States, dwindles into a shrub on the mountains of Scotland and in the north of Africa; its degeneracy being occasioned in the one case by extreme cold, and in the other by extreme heat. Even within America the absolute character of trees, relative to climate, is obvious. The American or white elm, *U. Americana*, is a hardy and very handsome species and attains to a large size in some parts of the country; the old tree on Boston Common was a representative of this species; while elsewhere it is considered only an ornamental tree.

Climate may be considered in regard to the average yearly and monthly temperature, and the degree of atmospheric moisture. A high annual temperature is no proof that a climate is suitable for trees; but a high summer temperature is suitable for many kinds, though the winter temperature may be very low. Thus the oaks and other trees of North America, attaining there a prodigious size, survive a winter as cold as that of St. Petersburg, where no native oaks are found; but North America enjoys a very high temperature during the summer, which rapidly develops the foliage, and matures the young shoots, enabling them to withstand the most rigorous winter. The much larger rainfall of that portion of America, as compared with St. Petersburg, has doubtless important bearings on the question. In England the average temperature of the year is as great as that of the oak countries of the United States; but summers in the former country are comparatively cold, moist, and more cloudy; and though its winters are much milder than those of the latter, the spongy, unripened young shoots are always more or less injured by frost.

Evergreen trees form an important division of the vegetable kingdom; and of these there are two classes, distinct relatively to climate and temperature. The first comprises the conifers, which endure a degree of cold as great as that in which any deciduous tree thrives; and the second, the broad-leaved evergreen trees such as the holly, box, laurustinus, laurel, evergreen oak, cork-tree, and the evergreen magnolia, trees of comparatively mild climates, and always indigenous on islands or on continents at low elevations, and at no great distance from the sea; hence the large number of evergreen trees which grow well in America, compared with those that survive the winter in the same latitude in Europe.

TREES SUITED FOR PARTICULAR PURPOSES.

1. Coniferous or resinous trees; 2. Hard-wood trees, and 3. Soft-wood trees.

1. Conifers.

Coniferous trees are characterized by straight, erect trunks, with branches in regular tiers, which do not acquire the size of timber. They never send up shoots from the stool when cut over at the ground. The leaves are generally linear or needle-shaped, without veins, and evergreen. The seeds are produced in cones, and the whole plant is more or less resinous. They belong to the Gymnosperms, a family of the Dicotyledons.

Many conifers might be mentioned which, though not universally producing timber, are worthy of cultivation. Of the American pines we have the *Pinus Strobus*, L., Weymouth pine, which furnishes the white wood of American commerce. Several Californian pines have been introduced; of these *Abies Douglasii* is the most promising. Of Asiatic conifers, *Cedrus Deodara Libani* are much grown for ornament. *Pinus excelsa*, which resembles the Weymouth pine, and *Abies Smithiana*, and *Webbiana* grow fairly in many parts of Britain; the Smithian pine being apparently the best adapted to the climate.

Broad-leaved trees, in contradistinction to needle-leaved, are classed, according to their timber, in two subdivisions, hard and soft wood trees. They are characterized by large trunks and widely spreading, woody branches, and broad leaves with branching veins; they send up shoots from the stool when cut over by the ground; and they are deciduous. They belong to the Dicotyledons.

2. Hard-wood Trees.

The *hard-wood timber trees* are characterized by the comparative hardness and durability of their wood, and comprise the oak, ash, elm, beech, sweet chestnut, walnut, and many others. The wood of the oak is the strongest and most durable of any timber trees; but on account of the slowness of its growth it is not always the most eligible for planting. From the demand for oak in the arts, the price of trees fit for that purpose is always considerable; but the largest trunks employed in naval architecture do not afford an adequate return for the number of years they have stood on the ground. Accordingly, we find that the governments both of France and England grow this description of timber largely in national forests. The wood of the oak is applicable to a greater number of uses than that of most other trees. Houses, ships, furniture, and machines may be formed almost entirely of oak, and consequently there is a ready sale for this timber almost everywhere. Hence there is more inducement to plant it freely than any other hard-wood tree. It is easily raised from acorns, which ought to be collected from the most vigorous trees. The British oak is a native of most parts of Europe, but not of Asia, Africa or America.

The *ASH* (*Fraxinus excelsior*, L.) is possibly next in value to the oak as a timber tree. As the value of the timber depends chiefly on its toughness and elasticity, it is best grown in masses where the soil is good; the trunk is thus drawn up free from large side-branches. The tree is a native of Central Europe and of the United States, and is easily propagated from seeds. It throws up strong root shoots. The timber is much used for agricultural implements, and by coachbuilders and wheelwrights. The supply of this valuable timber is annually becoming more limited on account of its great consumption in manufactures.

Of the *ELM* there are two species in Europe, the common or narrow-leaved elm (*Ulmus campestris*, L.), and the Wych or broad-leaved elm (*Ulmus montana*, L.). There are many varieties, such as the Dutch elm and the smooth-leaved or Huntingdon elm, the latter much valued for its timber. The narrow-leaved elm is not very common in the north, but in the temperate zone it becomes a handsome tree; and the timber is used for important purposes in ship-building, as well as in the construction of machines and agricultural buildings. There are other species and varieties of European elms, and several kinds of American elms, but none are deserving of culture es-

pecially as timber trees. The elm is subject to the ravages of several insects, especially *Scolytes destructor*.

The *BEECH* (*Fagus sylvatica*, L.) is one of the largest of forest trees, particularly on chalky or sandy soils. In England and America the beech has a remarkable power of holding the ground where the soil is congenial, and the deep shade prevents the growth of other trees. It is often and most usefully mixed with oak and Scotch fir. The timber is not remarkable either for strength or durability. It was formerly much used in mill work and turnery, but its principal use at present is in the manufacture of chairs, bedsteads, and a variety of minor articles. It is a native of the south of England, and of various parts of the continent of Europe. There are some varieties, particularly the purple and weeping beech, and there are several species, natives of North America. It is propagated by its mast, which is produced plentifully in fine seasons.

The *SWEET CHESTNUT* (*Castanea vulgaris*, Lam.) is a large, long-lived, deciduous tree, of rapid growth while young, and attaining a vast size in South Europe (e.g., the renowned chestnut of Mount Etna). It was early introduced to England, and is one of its most ornamental trees. The timber bears a striking resemblance to that of the British oak, which has been mistaken for chestnut; but it may be distinguished by the numerous fine medullary rays. Unlike oak, the wood is more valuable when young than old. It is a native of Asia, North Africa, and North America. In Spain and Italy it is grown for its fruit, in Britain, for ornament. In the south of England in warm seasons it ripens its fruit from which plants are easily raised.

The *COMMON SYCAMORE*.—Generally in the United States is found on low lands and near water courses, but it will not thrive on stiff clays, nor on dry sands or chalks. The Norway maple (*A. platanoides*, L.) is a hardy tree, used as a breakwind in exposed situations on the east coast; but neither it nor the other species from Europe or America seems to deserve cultivation for the sake of its timber. The sugar maple (*A. saccharinum*, L.) forms extensive forests in North America. It has been introduced into Britain for a century, but is rather tender and requires a dry sheltered situation. It is propagated by imported seeds, and it is doubtful if it can be profitably cultivated in that country.

The *COMMON BIRCH* (*Betula alba*, L.) is a tree of the second rank, worthy of culture in inferior soils and situations, especially as coppice-wood. The twigs, in some parts of England are sold to the broom-maker, and give a fair return. The tree seeds freely, and is easy of management. It is often planted in poor soil as a nurse for oak and sweet chestnut. It yields excellent fuel. The wood is used for carving, furniture and agricultural implements, and in some parts of America and Europe for building material. The bark, covered with a layer of earth, is used in roofing, and baskets and boxes are made of it.

3. Soft-wood Trees.

The soft-wood trees are remarkable for the rapidity of their growth, the lightness and whiteness of the wood, and often for their early decay.

ROADSIDE TREES AND HEDGES.

Little attention is paid to the planting of trees along roadsides, and in such situations healthy or well-shaped ones are seldom seen. A pit should be made of sufficient size (2 to 3 feet square), and filled with

good soil mixed with rotten dung. The plants require to be fenced, and for the first summer occasionally watered, and the earth dug and kept clear of weeds. In forming avenues and boulevards, the trees should be planted 30 feet apart, and if space allows of it, there should be a double row to form a shady arch for pedestrians. The oversight of these is sometimes given to a surfaceman, or to a man appointed for the purpose, and it should be his duty to maintain the avenues complete. Trees, especially in or near large towns, are subject to injuries which disfigure their appearance or retard their growth, and not infrequently destroy the plants. To prevent this it is customary to surround the stem with a cradle, or matting, or thorny branches.

Hedge-plants are of great importance both for shelter and protection of plantations. By far the best for outside hedges are the common hawthorn and the wild crab. In the western United States the *bois d'arc*, or "Osage orange" is the almost exclusive hedge-plant.

PROPAGATION AND CULTURE IN THE NURSERY.

Nursery Culture.—A nursery is a plot of ground devoted to the propagation and rearing of trees; it should as far as possible be exempt from the influence of frost, which prevails in low situations, and it ought to contain a variety of soils. As a general principle, all seeds will germinate in any soil provided it contains vegetable matter, and is friable, free of stones, and well drained, with a convenient supply of water. With regard to climate, all deficiencies which occur in America may be met by glazed frames for starting the more tender kinds. It is the interest of the nurseryman to have his nursery in a fine climate, and in deep fertile soil, that he may raise large, vigorous plants in the shortest period; but it is the interest of the purchaser to have the plants reared in a climate and soil inferior to that into which they are to be transplanted, because, when this is done, instead of the plants receiving a check, as is usually the case, they will be improved by transplanting. The strength of a plant and its suitability for successful transplanting consist in all its parts being developed, in the thorough ripening of its wood, and in the dormant state of its fibrous roots. If by any mode of culture these requisites can be obtained, together with the long and thick shoots which are produced by growing the plants in deep rich soil, so much the better; but in the climate of America trees reared in nurseries with inferior and unmanured soil are likely to prove most hardy. Those who plant in mountainous districts will always find it better to have their nurseries on the sides of mountains than in the valleys.

Propagation.—Trees are chiefly propagated by seeds, but also by cuttings, layers, budding, and grafting. The timber trees of all countries are raised from seeds, with a few exceptions, such as the poplar and willow, which are raised from cuttings, and some species of elm, lime, and a few others, which are raised from layers or by grafting. Thus, all the American oaks may be grafted on the common British oak. All plants which do not ripen seeds readily are propagated artificially, and that mode is preferred by the nurseryman which experience has proved will produce the largest and most vigorous plants in the shortest time. According to some writers, seedling plants are of greater durability than those raised in any other way; but though this may be true in some cases, it is not universally applicable, as we know that a bud produces as perfect a plant as a seed; the only difference being

that the bud seems more fully imbued with the peculiarities of the individual which produced it than the seed. The poplar, willow, vine, etc., have been propagated by cuttings from time immemorial, and appear to possess respectively the same properties now that they did in the days of the Romans. Seeds should be collected when mature from the best specimens; and should either be sown immediately, or preserved in a place where they will undergo few atmospheric changes till the proper sowing season, which in most cases will be the following spring. Nature, it may be observed, sows all her seeds soon after they are matured; that is, they drop from the tree upon the ground in autumn or the beginning of winter, or, in the case of some trees, such as the conifers, not till spring; but when seeds are thus left to sow themselves many are destroyed by animals, many fall in unfavorable positions for germination, and only a small proportion produce plants. It is for the arboriculturist to study nature's mode of sowing, and to imitate only her favorable features.

Of trees indigenous to the United States the most remarkable is the Sequoia, a genus of the coniferous family, and of the suborder of cypresses. This tree is especially remarkable for its enormous size. They are found in California only, and are of two species, the redwood proper, *S. sempervirens* found in the Coast Range, and *S. gigantea*, called the big trees, or mammoth trees, of that State, growing only on the western slope of the Sierras. This entire region is given to the production of enormous tree growths, but the sequoias are remarkable not only amid their immediate surroundings but among the great trees of the world. This giant also stands alone in kind. To the cypress family it has only a distant affinity.

The mammoth tree of the Sierra Nevada was first seen by white men in 1852. Accounts of the Calaveras grove first appeared in the California newspapers. The tree figured first as *Wellingtonia gigantea* in the *Gardiner's Chronicle* (London, 1854), but afterwards, through various botanical reasons, obtained and kept its present name, it having been decided that it was of the same species with the redwood, sequoia. The tree nowhere forms a forest by itself, but grows with other coniferous trees, and generally in patches or groups. Its range is very small, in latitude only three or four degrees, and in height above sea level from 4,000 to 7,000 feet. The best known and oftenest visited group of these trees is that first discovered, known as the Calaveras grove. The grove south of the Yosemite Valley is a government reservation. This contains the tree called the Grizzly Giant, which is 93 feet in circumference. Various estimates of the age of these trees have been made, and some of them have passed two thousand years of this world's history. The species was more common in earlier ages. There is no probability of renewal. There are no young trees. The day will come when, with innumerable other growths and species, it will have passed away.

The other California member of the family, the redwood, grows from Monterey to the Oregon line. It usually constitutes a forest by itself, the most splendid conceivable. The trees are from eight to twelve feet in diameter, and from 200 to 300 feet high. They do not branch, until they reach a height of 100 to 150 feet, and being thickly grouped, and their trunks straight, their tops form a dense green canopy over innumerable columnar brown trunks. The timber is valuable, and these splendid forests are rapidly disappearing.

Of the other conifers of the United States, the most valuable are the White Pine (*Pinus strobus*), and the *P. Australis*, the hard, pitch, or yellow pine of the Southern States. *P. rigida*, which is the hard or pitch pine of the Northern States is probably next in value. After these come an extensive family of pines, immensely valuable, because of wide distribution, and the unequalled qualities of the wood for building purposes, most of them furnishing pieces of great length and size. For the purposes of shipbuilding, the hackmatack, a larch, probably stands first in value. Next come the spruces, tougher than white pine. This timber is especially adapted for spars. Hemlock, a spruce, furnishes a coarse and cheap lumber at the north for the construction of fences, barns, and outhouses, and for the commoner kind of packing boxes for merchandise. All the cedars furnish timber valuable for posts and shingles, owing to their durability. The Virginia cedar, *Juniperus Virginia*, of wide distribution through the middle and southern States, furnishes a beautiful and fragrant wood for cabinet work, and is of especial value in the manufacture of small articles such as pencils and penstocks.

Of the Amentaceous trees of the United States the oaks come first in general usefulness and in popular estimation. There is an enormous family of these, forests composed of three or four varieties growing together sometimes to the partial or entire exclusion of other trees. That which is known as white oak *quercus alba*, stands first. It often grows to a height of 80 feet, and sometimes attains 100 feet, with a diameter of from two and one-half to four feet. It is of slow growth, is very handsome, and is the ideal forest tree in appearance, besides possessing a general utility perhaps unexampled. It is indispensable for frames where great strength is required, for the axles, spokes, hubs and felloes of heavy wagons, for the body-frames of coaches and buggies, for cooperage of all kinds, and for an immense number of uses in common life. Post oaks, bur oaks, pin oaks, red oaks, chinquapin oaks, and others of the extensive family bearing local names, come after. Some of these varieties are hardly less in value than the white oak, and others are for certain purposes preferred.

Next after the oak for especial value in certain American industries where wood of peculiar quality is required probably come the Hickories. The hickory trees are a North American species exclusively, and the name is local, since in New England the wood is often erroneously called walnut. It is the common designation of the genus *Carya* (*Juglandaceae*). There are at least four species known, and often found together in the same forest. That which is most valuable is the shell-bark, or shag-bark, white hickory, having the peculiar shaggy bark, hanging in huge irregular dry scales, which gives it its name. This yields nuts of delicious flavor, constituting an article of commerce. The timber is especially valuable, and almost exclusively used for axe-helves, hammer-handles, awl-hafts, and all purposes where strength and toughness in small space are required. Of "second-growth" hickory, meaning the growth which springs up after the grown trees have been cut away, the spokes and felloes, and often the thills and reaches of the best American light vehicles are made, and for such purposes its peculiar qualities are indispensable, since so much strength and elasticity could hardly be combined with an appearance of lightness and fragility with any other wood.

The Walnut (*Juglans*) is known in the Atlantic States in at least two species, and in the middle and western by four or five. The variety commonly

known as black walnut is a cabinet wood (*Juglans ingia*), of which the heart is of a violet-brown when first cut, turning darker with age. It is susceptible of a high polish, is often wavy or curled in grain, is tough and strong, and remarkably free from shakes and knots. The wood has a peculiar odor which clings to the articles made of it for many years.

For building and some cabinet purposes one of the noblest American trees is that known as Yellow Poplar, really tulip. This tree belongs to the Magnolia family, and is the largest, most beautiful and most useful of the tribe. It grows to perfection in the middle States, but has become scarce in the comparatively brief time since they were settled by white men.

The American ash is a timber tree of the first class, the toughness of the wood, combined with its lightness being remarkable. It is also remarkably straight grained and easy to work. Of the three or four varieties the white ash stands first, and it would be difficult to find any substitute for this in the making of agricultural machines, the handles of rakes and forks, the shafts and poles of carriages, etc.

Space is not available for the enumeration and description of more than a very few of the valuable natural timber trees of the American forest, and most readers will be able to supply defects from memory and experience. Chestnut, beech, maple, sycamore, the small laurels, the apparently insignificant "dog-woods," with wood almost like *lignum vitæ*, the magnificent elms, the hollies, the gum tree family, the locusts and cherries, are common over large tracts of country. Then there might be named the trees of special localities like the live oaks and some of the peculiar branches of common families which are found on the Pacific coast. All these have entered largely into the prosperity and growth of the country, and all have been recklessly and enormously wasted. The log-heap smouldering in the clearing is familiar to every extensive traveler. The hardest and most patient toil in America has been given to the destruction of these splendid growths for more than a century for the mere purpose of being rid of them. It was absolutely necessary, yet the want, now almost irreparable, will be felt for an indefinite period to come.

Not one landowner in ten thousand can bring himself to feel any interest in the question of renewing the destroyed growth unless an immediate demand for it exists, and when it does exist he sees the impossibility of gaining any advantage from it during an ordinary human life. Arboriculture is an interest in the future, and may be said to exist only where, on the wide prairie lands of the west, a palpable and immediate want was to be supplied by the quickest growths in the least possible time. Here, impelled by necessity, a fair effort has been made, stimulated by a timber-culture act of Congress in regard to public lands, while in other regions the old destructive process of clearing and burning still goes on. Even the call during the past forty years for immense quantities of timber for railroad ties has not altered the situation. The demand has been almost exhaustive during the last twenty-five years of this time and the result of greater cost and final scarcity has been foreseen. Yet the great railroad companies have made in few instances, if any, any earnest effort to propagate hard-wood timber which in a growth of twenty-five years would supply their demands for ties and continue to do so for all time to come. The only instance worthy of mention of extensive arboriculture is not in reality that at all, being the making of many thousands of miles of hedge in the western States of the *bois d' arc* or "Osage orange."

It cannot be expected that landowners shall keep the original forest growth untouched. Arboriculture consists rather in a renewal of those growths. It is known to be more economical to renew a growth of wood, and to cut it off at intervals, than it is to allow a growth to stand for a century or more. For the land will yield many times as much in the former case as in the latter. There are two modes of tree propagation, only one of which has so far been tried here, that being the culture of trees, as mentioned, on new land in the west, the other being the regrowth of timber on the land where the original forest has been cut away. The most common experiment in cases of new growth, where attention has been paid to the subject at all, has been the thinning out process. This leaves the medium-sized trees left standing in a position to shade and retard the growth of everything below them. The best success will be seen in those unintentional cases where there is a clearing from which all, or nearly all, the trees have been cut, and which has then been abandoned. If twenty-five or thirty years have passed, the passing observer will be able to note a growth which is sufficient to demonstrate the entire practicability and profit of arboriculture.

Trees grown by the former method, intentionally, on the new prairie lands of the west, are as yet not old enough, or their growth extensive enough, to demonstrate the merely commercial aspects of the enterprise. These growths were started from seeds; the slowest way in the beginning, but probably the best in the end. Already it may be said that, aside from the hedges, these growths have changed the appearance, and possibly modified the climate, of a notable extent of the country. The old defined horizon has been changed into something undulating and irregular. The little towns beside the railroads on the bare and cheerless prairie have now, in the few years that have passed almost unnoted, shaded and beautiful streets. Some of these growths are so dense that a perfect stranger might easily be persuaded that the groves were natural growths of the country. Indeed, in arboriculture in the west, there seems to be no really discouraging feature, and it is very possible that in time to come the best regulated supply of timber for daily and even commercial use will be found in those States where at first there was none at all. The sod house man loves trees. He wants them to stand thick beside his home, and to shade his door and surround his farm. The two sets of pioneers have started with a distinct difference of intention, in both cases local, but both entailing results which may seem startling in fifty years.

ARBROATH, or ABERBROTHOCK, a seaport and manufacturing town in Scotland, in the county of Forfar, seventeen miles northeast of Dundee, and sixty miles north-east of Edinburgh. Population, 21,758.

ARBUTHNOT, JOHN, a celebrated physician, wit and man of letters of the age of Queen Anne, was born at Arbuthnot, Scotland, in 1665. His father was a clergyman of the Scotch Episcopal Church, who was compelled by the Revolution to resign his charge, and whose family were consequently dependent on their own exertions. Young Arbuthnot studied at the University of Aberdeen, where he took the degree of M. D. He proceeded soon after to London, and for a time supported himself there by teaching mathematics. His first published work was a translation, with considerable additions, of a treatise by Huyghens, called *of the Laws of Chance or a Method of Calculation of the Hazards of*

Game, 1692. About this time there was much speculation concerning the geological formation of the earth, and Dr. Woodward published an *Essay towards a natural history of the earth*, in which some curious views were propounded with regard to the deluge. This essay Arbuthnot attacked with great success in his *Examination of Dr. Woodward's Account of the Deluge*, &c., London 1695. By this work he was brought into prominent notice, and not only gained means to extend his practice, but at the same time brought himself into connection with the circle of wits and literary men who formed the chief glory of the age. He followed up the work on Dr. Woodward by another on the usefulness of mathematical learning, and contributed to the Royal Society an interesting memoir, called *An Argument for Divine Providence drawn from the Equal Number of Births of both Sexes*, which procured him, in 1704, admission as a Fellow to the Royal Society. About this time a happy accident introduced Arbuthnot to Prince George of Denmark, who was seized with sudden illness when on a visit to Epsom. Arbuthnot, who chanced to be there at the time, was called in, and ever afterwards continued to be physician to the prince. In 1705, at the especial request of the Queen, he was made her physician extraordinary, and four years later he became Royal Physician in ordinary. In the same year he was elected a Fellow of the Royal College of Physicians. He was now in the very centre of the literary society of the time, and in his great talents, massive learning, and brilliant wit enabled him to take a prominent place. He was on terms of close intimacy with Pope, Swift, Gay, and Parnell, and quickly became one of the foremost literary men of the Tory party. In 1712 appeared the celebrated political allegory, called *the History of John Bull*. The object of this admirable piece of satire was to throw ridicule on the duke of Marlborough, and to excite among the people a feeling of disgust at the protracted war then being carried on against Louis of France.

The death of the Queen in 1714 was a severe blow to Arbuthnot. He lost his post as court physician, and was much impaired in his means. He appears about this time to have paid a short visit to Paris, and on his return took up his residence in Dover street. In 1723 he was made one of the censors of the Royal College of Physicians, and in 1727 had the honor of delivering the Harveian oration. In 1731 he published an *Essay Concerning the Nature of Ailments*, which has been frequently republished, and has been translated into German. In 1733 he wrote an *Essay on the Effects of Air on Human Bodies*. He died in February, 1735.

ARBUTUS, a genus of small trees and shrubs belonging to the order of Ericaceæ. *Arbutus unedo*, the strawberry tree, is a native of the south of Europe, found also in Asia and America.

ARC (Lat. *arcus*, a bow) is any part of a curved line. The straight line joining the ends of an arc is its *chord*, which is always less than the arc itself. Arcs of circles are *similar* when they subtend equal angles at the centers of their respective circles; and if similar arcs belong to equal circles, the arcs themselves are *equal*. The length of an arc is readily found if the angle which it subtends at the center of the circle is known, and also the length of the whole circumference. Let the whole circumference be 100, and the angle of an arc 50°, the length of the arc is

$$360^\circ : 50^\circ :: 100 : \frac{100 \times 50}{360} = 14 \text{ nearly.}$$

ARC, JOAN OF. See JOAN OF ARC.

ARCADE, in street architecture a covered way or passage, either open at the side with a range of pillars, or completely covered over. The finest arcade of this

description are to be found in Paris. Some have open sides, such as those in the Rue de Rivoli, Palais Royal, and old Place Royal; others, such as the Passages des Panoramas, Jouffroy, and de Princes, are covered passages, and form convenient thoroughfares. A few, like the Passages Choiseul and de l'Opera, are favorite lounges. They are all more or less lined with elegant shops. There are two specimens of covered passage-arcades in London, the Burlington and Lowther, but they are very inferior in style to those in Paris. The arcade which runs round three sides of the Square of St. Mark at Venice is the finest of its kind. In Gothic architecture the term signifies a range of arches, supported on columns or piers, and either open or attached to a wall.

ARCADIA, an inland and mountainous country of ancient Greece, bounded on the N. by Achaia, on the W. by Elis, on the S. by Messenia and Laconia, and on the E. by Argolis, and almost shut in from the neighboring states by a natural rampart. Its most important heights were Cyllene, the birth-place of Hermes, in the north-east, Erymanthus in the north-west, Artemisium and Parthenium in the east and Mænalus and Lycæus in the south. It was watered by the Alpheus, the largest river of the Peloponnesus, the Helisson, the Ladon, the Erymanthus, and a number of smaller streams which cut their way, in many cases by underground passages, through the limestone rocks. In the east there were several lakes, as those of Orchomenos and Stymphalus; and in the north-east, near Nonacris, was the great waterfall of the Styx, which produced such a deep impression on the ancient Greek mind. Arcadia seems to have been inhabited from the earliest times of Grecian history by the same race of people, which down to the days of Roman dominion continued to be distinguished from the neighboring states by greater simplicity and inertness of life. The most important towns in Arcadia were Tegea, Stymphalus, Cleitor, Pallantium, Pheneus, Carayæ, Nonacris, Methydrium, Herææ, Mantinea, Lycosura, according to Pausanias, the most ancient town in Greece, and Megalopolis, one of the most recent.

ARCESILAUS, a Greek philosopher, and founder of the New or Middle Academy, was born at Pitane in Æolia, about 316 B.C. He received careful training in his youth from the mathematician Autolycus, and then proceeded to Athens, where for some time he studied under Theophrastus. He was gained over to the Academy by Crantor, with whom he continued to live on terms of the closest intimacy. After the death of Crantor, Arcesilaus continued to study under Polemo and then under Crates, whom he succeeded as leader of the school. There is a little doubt as to the philosopher's mode of life. According to some, he lived in extravagant, even profligate style, and Diogenes Laertius tells us that he died in his 75th year of excessive drinking. But the testimony of others, *e.g.*, Cleanthes, seems to show that he practised extreme moderation; and some of his practical precepts tend to confirm this view. He was much beloved and respected by the Athenians, and is celebrated for his acuteness, eloquence, and learning.

ARCH, in building, a portion of mason-work disposed in the form of an arc or bow, and designed to carry the building over an open space. The simplest and oldest expedient for supporting a structure over a door-way is to use a single stone or lintel of sufficient length. On account of the difficulty of procuring stones of great size, this expedient can only be used for moderate apertures; nor can it be applied when there is to be a heavy superstructure, because the weight resting on the lintel would cause a compression of the upper, and a distension of the under side. Now, no kind of stone

can bear any considerable distending strain, and thus stone-lintels are liable to fracture. The ancient Greek temples afford instances of the use of horizontal lintels of considerable size, but these architraves carry only the cornice of the building. The employment of a colonnade with flat architraves to support an upper story is contrary to sound principles, and, even in the case of ordinary houses, we see that the builder has been fain to relieve the pressure on the lintel by means of a concealed arch. In stone-work we must depend on compression alone.

When a lintel had been accidentally broken in two, we may suppose that the masons had set the ends of the halves upon the door-posts, and brought the broken ends together. In this way there would be formed a support for the upper building much stronger than was the stone when entire; only there is a tendency to thrust the door-posts asunder, and means must be taken to resist this out-thrust. The transition from this arrangement to that of three or more wedge-shaped stones fitted together was easy, and thus the gradual development of the arch resulted.

So long as such structures are of small dimensions no great nicety is required in the adaptation of the parts, because the friction of the surfaces and the cohesion of the mortar are sufficient to compensate for any impropriety of arrangement. But when we proceed to construct arches of large span we are forced to consider carefully the nature and intensity of the various strains in order that provision may be made for resisting them.

Until the laws of the equilibrium of pressures were discovered, it was not possible to investigate these strains, and thus our knowledge of the principles of bridge-building is of very recent date; nor even yet can it be said to be perfected. The investigation is one of great difficulty, and mathematicians have sought to render it easier by introducing certain pre-supposed conditions; thus, in treatises on the theory of the arch, the structure is regarded as consisting of a course of arch-stones resting on abutments, and carrying a load which is supposed to press only downwards upon the arch-stones. Also cohesion and friction are put out of view, in other words, the investigation is conducted as if the stones could slide freely upon each other. Now, if the line of pressure of one stone against another cross their mutual surface perpendicularly, there is no tendency to slide; and if this condition be adhered to throughout the whole structure, there must result complete stability, since the whole of the friction and the whole consistency of the cement contribute thereto. But if, in any case, the line of pressure should cross the mutual surface obliquely, the tendency to slide thereby occasioned must be resisted by the cohesion, and so the firmness of the structure would be impaired. Hence an investigation, conducted on the supposition of the non-existence of cohesion, must necessarily lead us to the best possible construction. But we can hardly say as much in favor of the hypothesis that the load presses only downwards upon the arch-stones. In order to place such a supposition in accordance with the facts of the case, we should have to dress the inner ends of the arch-stones with horizontal facets for the purpose of receiving and transmitting the downward pressure. But if, as is usually the case, the inner surfaces be oblique, they cannot transmit a vertical pressure unless in virtue of cohesion, and then this hypothesis of only downward pressure on the arch-stones is not in accordance with the fundamental principle of stability. In a thorough investigation this hypothesis must be set aside, and the oblique pressure on the inner ends of the arch-stones must be taken into account. Since the depth of the arch-stones is small in comparison with the whole dimensions of the structure, and since the line of the

pressure transmitted from one to another of them must always be within that depth, it is admissible to suppose for the purpose of analysing the strains, that the arch-stones form an exceedingly thin course, and that their joints are everywhere normal to the curve of the arch. Eventually, however, the depth of the arch-stones must be carefully considered.

In every possible arrangement of the details, the horizontal thrust at the crown of the arch is transmitted to and resisted by the ultimate abutments. The only effect, in this respect, of varieties in the form of construction is to vary the manner of the distribution of that strain among the horizontal courses. Hence one great and essential element of security,—the first thing, indeed, to be seen to,—is that the ground at the ends of the proposed bridge be able to resist this out-thrust. Another, and not less important one is, that the arch-stones be able to withstand the strains upon them. In this respect much depends on the workmanship; it is all important that the stones touch throughout the whole surfaces: if these surfaces be uneven the stones must necessarily be subjected to transverse strains, and so be liable to fracture. The practice, too common among house-masons, of cheaply obtaining an external appearance of exactitude, by confining their attention to a chisel-breadth around the outside, is not permissible here, nor should any reliance be placed on the layer of mortar for making up the inequalities.

The ability of a substance to resist a crushing pressure is generally measured by the length of the column which it is able to support, without reference to the horizontal section; but it may be questioned whether this mode of estimation be a sound one, for it does seem natural to suppose that a block three inches square should bear a greater load than nine separate blocks each one inch square, seeing that the centre block in the entire stone is protected on all sides; and thus it is possible that we under-estimate the greatest practicable span of a stone arch. This difficult subject belongs to the doctrine of "Strength of Materials."

ARCHÆOLOGY, from ancient, and a description. The term *Archæology*, like that of *Antiquities*, has been employed, until a very recent period, in a sense so restricted and arbitrary as strikingly to contrast with the latitude admissible according to the original derivation of the word. Literally it signifies the study of antiquity or ancient things; but its precise significance has been determined from time to time by the range of study and research most in favor. To some extent it has always been recognized as embracing whatever pertained to the early history of any nation, but in its details it was applied almost exclusively to the study of Greek and Roman art, or of classical antiquities generally. The progress of geology, and the application of sound principles of induction to the study of primitive antiquities, have wrought a great revolution, and few studies now rival archæology in comprehensive interest.

In looking at the succession of strata of the earth's crust it was assumed till recently that the student of man and his remains is limited to the latest superficial formation of post-tertiary strata. To the palæontologist was assigned all ancient animal life of the fossiliferous strata, while the archæologist treated of man and his works as things essentially distinct. The diverse functions of the two sciences are still clearly recognized; but the archæologist is no longer supposed to be excluded either from quaternary or tertiary strata in his search not only for the remains of human art, but for the osteological evidences of man's presence contemporaneous with the fauna of such geological periods. One class of archæologists, accordingly, confidently anticipate the recovery not only of works of art, but of the fossil

remains of man himself, in the pliocene, or even the miocene strata. So far, however, as any reliable evidence can guide opinion, it scarcely admits of question that neither has hitherto been found in older deposits than the later tertiary, or quaternary.

The actual remains of man, the specific form of his osseous structure, and above all of his skull, now receive the minutest attention; and the department of anthropology to which such investigations are specially assigned has latterly acquired a fresh interest from the inquiries suggested by novel theories as to the possible evolution of man from lower animal organisations. Nevertheless, the researches of the palæontologist and of the archæologist are based on essentially distinct evidence. The life of geological periods is investigated by means of the fossil bones and teeth which alone survive. Or if to these have to be added such illustrations of habits, food, and structure as are furnished by means of footprints, coprolites, and the like subsidiary evidence, still all are traceable, directly or indirectly, to the living organism. Man, on the contrary, in times altogether preceding history, is chiefly studied by means of his works. Archæology thus forms the intermediate link between geology and history, though the reaction, at the revival of learning in the 16th century, which tended for a time to subordinate arts and science alike to classical authority, reduced it within greatly narrower limits. Nevertheless, the fitness of the term for the most comprehensive definition in relation to all which pertains to the past could not be entirely overlooked, and it is even employed repeatedly by Dr Prichard as nearly synonymous with palæontology. In this, however, he has not been followed, and the name is now universally adopted to designate the science which deduces the history of man from the relics of the past. So comprehensive a subject necessarily admits of great subdivision. The most important general division will be treated of separately in the article on CLASSICAL ARCHÆOLOGY (p. 437, *seq.*), while interesting branches of the study will be reviewed under the heads of Egyptian, Etruscan, Assyrian, Mexican, and Indian antiquities. Numismatics, pottery, heraldry, hieroglyphics, palæography, and other subdivisions in like manner deal with important details, and help to illustrate the comprehensiveness of the subject.

The innate cravings of the human mind for an insight into the future have shaped themselves into many forms of divination and astrology. But this desire is not more universal than that which prompts man to aim at a recovery of the secrets of the past. The question *Whence?* even more than that of *Whither?* is found to give shape to the mythic legends of the rude barbarian, and to constitute an important element in the poetry and mythology of every nation's oral and written history. With the progress of society such indices of the past are subjected anew to critical analyses; and we accordingly find abundant traces of an archæological spirit in the literature of every civilised nation. The influence of the same craving for a mastery of the past is seen adapting itself to the spirit of the age at every epoch of great progress. The revival of art and letters in the 14th and 15th centuries was signalled by a new appreciation of Greek and Roman models; and while the progress of opinion in the 16th century was accompanied by an abandonment of mediæval for classic art, the tendency of Europe in our own day, amid many elements of progress, has been singularly consentaneous in the return not merely to mediæval art, but to mediæval modes and standards of thought, and in the attempt to attain a higher excellence than has been yet achieved by a more perfect development of the ideal of the middle ages.

The alliance of archæology with geology, and the direction of geological research to the evidences of the antiquity of man, have largely contributed to its expansion, until in its comprehensive unity it embraces the entire range of human progress from the infantile stage of primeval arts to the earliest periods of written records. It has thus been developed into a systematic science, by which the intelligent investigator is enabled to pursue his researches with the aid of evidence older than all written chronicles, and to recover chapters of national infancy and youth heretofore deemed beyond recall. The geologist, with no aid from written records, follows out his inquiries through successive periods of the earth's history, and reveals the changes it has undergone, and the character of the living beings which animated epochs of the globe ages before man was called into being. Beginning with the traces of life in the primary fossiliferous strata, he passes on from system to system, disclosing a vast succession of long extinct life, until in the latest diluvial formations he points to the remains of animals identical with existing species, and even to traces of human art—the evidence of the close of geological and the beginning of archæological periods. Here archæological science ought to be ready to take up the narrative, and with a more comprehensive minuteness of detail and greater certainty as to the conclusions arrived at. Such, however, until very recently, has not been the case. The geologist himself long confused the records of the transitional by his mistaken reference of all diluvial traces to the Noachian deluge; and when, pausing, as he thus believed, at the dawn of the historic period, he turned to the archæologist for the subsequent chapters of the history of life on our globe, it was only to receive a record of Roman traces at best but meagrely supplementing the minuter details of the historian. Nearly the same was the case with all historic antiquity, with the single exception of the wonderful monuments of Egypt, which preserve to us the records of a civilization in which we can recognize the origin of arts, letters, and all else to which the culture of the oldest historical nations may be traced.

Nevertheless, the evidences of the primitive arts, and the traces of a native civilization originating among the prehistoric races of Europe, had long been familiar to the antiquary, though he failed to form any intelligent conception of their significance as historical records. Their interpretation on an intelligent and systematic principle is mainly due to the archæologists and ethnologists of Denmark and Sweden, who from their very geographical position were happily freed from the confusing element of classical prejudices, and were compelled to seek in other than Roman sources an origin for the abundant traces of metallurgic art. Zealous British coadjutors speedily caught the hint, and freed themselves from the trammels which had so long narrowed their aim; the remains of primitive art were referred to true sources, or at least arranged under an intelligent system of chronological sequence; and thus the desultory and often misdirected labors of the antiquary have given place to researches characterized by scientific accuracy.

The system of primitive archæology thus introduced has since been modified and carried out into ampler details, as the fruit of more extended discoveries, chiefly effected in France and England; but the three primary divisions, the Stone, the Bronze, and the Iron Periods, are still retained. The arrangement is warranted alike by evidence and by its practical convenience, though later research has given to the stone period a comprehensiveness undreamt of before, and so led to its subdivision into two ages of prolonged duration, with distinctive characteristics of primitive art. (1.) The

Stone Period, as the name implies, is that in which the rude aboriginal arts, which the commonest necessities of man call into operation, are assumed to have been employed entirely on such available materials as stone, horn, bone, &c. (2.) The Bronze Period may in like manner admit of subdivision, though the term is conveniently employed, in its most comprehensive sense, for that era of progress in which the metallurgic arts appear to have been introduced and slowly developed—first, by the simple use of native copper, followed by the application of fire, the construction of moulds, and the discovery of such chemical processes as the alloying of copper and tin, and the consequent production of the beautiful and useful alloy which gives name to this the earlier metallurgic era. (3.) The Iron Period marks the era of matured metallurgic arts, and the accompanying progress consequent on the degree of civilisation which is the inevitable concomitant of such a state of things. While, however, those divisions hold good in their general application, they must not in every case be applied too rigidly. The archæologist is constantly recalled to the distinction between the researches of the paleontologist, as dealing with the traces of organic life, and his own study of the works of a rational being marked by all the diversities traceable to the reasoning and volition of the individual workman. Local facilities have also modified the arts of primitive man in various ways. In some localities, as in North America, pure native copper abounds; while on the other hand, in certain districts of Africa iron occurs in such a condition that it appears to have been wrought by the primitive metallurgist from very remote times.

All those periods embrace eras concerning which no contemporary written records exist; and in relation to most of them nearly as little is known directly as of the older periods with which the geologist exclusively deals. It need not therefore excite surprise that the process of induction established on this basis has been challenged by historical writers of high standing, but whose exclusive labors on the records of periods admitting of documentary evidence and charter proof render them little disposed to sympathise with a course of reasoning relative to the history of man, such as has, in the hands of the geologist, revealed so much in relation to more ancient life. The further, however, that research is pursued, alike into the habits of living races of savages, and into the characteristics of the oldest traces of primitive art, the more clearly does such a process of development, from the first rude working in stone to the highest arts of the skilled metallurgist, become manifest.

The Australians, the Maories of New Zealand, and the whole widely scattered races of the Polynesian Islands, the Caribs and other natives of the American archipelago, with all the nomade tribes of the New World, from Patagonia to the Arctic circle, were, when first discovered, without any knowledge of the metals as such, and supplied their wants by means of implements and weapons of stone, shell, bone, or wood. The civilized Mexicans and Peruvians, on the contrary, when first visited by the Spaniards in the 16th century, were familiar with the working of copper as well as of gold,—though totally ignorant of iron, and also retaining for common purposes many of the primitive stone weapons and implements, only substituting the abundant obsidian of their volcanic region for flint. Greece passed from its bronze to its iron age within the period embraced in its literary history; and the mastery of the art working the intractable iron ore is traceable with tolerable clearness in the early history of Rome, not very long before it came in contact with the trans-Alpine barbarians. Among most of the Germanic and Celtic tribes iron appears to have been already known when they first

came in contact with the aggressive civilisation of the south; and from one of them, the Norici (in whose country, in the Austrian valleys of the Danube, this metal is still wrought with the highest skill), there is reason to believe that the Romans acquired the art of making steel.

If history is only to begin, as that of Britain has been made to do, with the date of the first collision with invading Rome, then, no doubt, stone and bronze periods are as meaningless as are eocene and miocene periods to the geologist who assigns the Mosaic deluge as the source of the earliest phenomena of his science. To those, however, who are willing to follow inductive reasoning to its legitimate conclusions it must be apparent that it is no visionary theory, but a system founded in well-established truth, which arranges the archæological records of primitive history and the remains of human art into stone, bronze, and iron periods. Even here, however, an important distinction in the employment of such materials as a basis of inductive reasoning indicates the greatness of the revolution involved in the introduction among the living creatures inhabiting this earth of a being endowed with intelligence, and supplementing the natural resources of animal life by arts even of the most primitive kind. It must indeed be borne in remembrance that geological and historical chronology are very different things, and that the idea implied in the contemporaneousness of strata bears a very slight approximation to the coincidence of contemporaneous events and productions of an historical era. The doctrine of geological continuity is indeed challenged in certain respects; but on the whole, the geological formations, with their included organic remains, may be assumed to obey a natural and unvarying order; and so, within the compass of geological periods, to be of contemporaneous origin. But, notwithstanding certain extreme assumptions, based on the theory of evolution, and involving the consequent existence of man in remote geological eras, so far as all actual evidence can yet guide us, it is correct to say that, geologically speaking, the entire history of man is embraced in one period. But in the works of art, which form the basis of archæological induction, a new element—that of mind, or the reasoning faculty, along with the imitative and social arts—is introduced, and greatly complicates its subdivisions. The stone period of Britain or Denmark, is analogous to that of the Polynesian Islands. So closely do their tools and weapons resemble each other that it requires a practised eye to distinguish the stone axe or flint lance-head found in an ancient British barrow from implements brought by some recent voyager from the islands of the Southern Ocean. Nor could the most experienced archæologist undertake in every case to discriminate between the flint arrow-head dug from some primitive barrow of undated centuries before the Christian era, and the corresponding weapon brought by some recent traveller from Tierra del Fuego or regions beyond the Rocky mountains. The inference is therefore legitimate, that in those Polynesians, Fuegians, or Indians of the North-West, we have examples of tribes in the same primitive stage as were the aborigines of Europe during its stone period. Chronologically, however, the stone period of Europe and that of the Pacific islands or the American continent are separated by thousands of years. In like manner, the bronze age of Mexico was undisturbed by all later elements when first brought into contact with the matured civilisation of Europe in the 16th century, while the close of that of Britain preceded the 1st century of our era. The same rule is applicable to the primitive archæology of all centuries; and a fertile source of error and miscon-

ception has already had its rise in the assumption that because Greece and Italy, Germany, Gaul, Scandinavia, and Britain, have all had their primitive stone and bronze periods, therefore the whole must have been contemporaneous. It cannot therefore be too strongly enforced as one of the most essential points of variance in the reasoning of the geologist and the archæologist, that the periods of the latter, though synonymous, are not necessarily synchronous; but that, on the contrary, nearly all the phenomena which pertain to the *natural history* of man, and to the historic development of the race, may be witnessed in their various stages in contemporary races of our own day—from rudimentary barbarism, and the absence of all arts essential to the first dawn of civilisation, to a state of greatest advancement in the knowledge and employment of such arts.

Some progress has already been made in an approximation to certain chronological data of such importance relative to such primitive periods of the history of nations. But the archæologist, as well as the geologist, is learning to deal with periods of time which cannot always be measured either by years or centuries, but rather must be gauged by those chronological stages in the history of our planet in which epochs and periods take the place of definite subdivisions of solar time. Nevertheless, geological evidence of changes which are known to have occurred within the historic period supplies an important key to the approximate duration of certain eras characterised by traces of human art; and while by the intelligent observation of such remains in the superficial strata, mingling with the fossil evidences of extinct and familiar species of animal life, the link is supplied by which man takes his place in unbroken chain of creative existence, sweeping back into so remote a past, the evidences of matured art pertaining to periods unrecorded by history supply later links of the same chain, and reunite the present with all former ages.

The system of primitive archæology which is found applicable to British antiquities so closely corresponds in all its essential features to that of Europe prior to the era of authentic history, that the purpose of such an abstract as this will be most conveniently accomplished by presenting its leading points as examples of the whole, illustrating these in passing by the analogous remains discovered in other countries. The apparent simplicity of a primitive stone period has been considerably modified by recent research; and the careful study of the remains of ancient art, in their relation to accompanying geological phenomena, or of the evidences of artificial deposition in caves, barrows, chambered cromlechs, cairns or other sepulchral structures, suggests the subdivision of prehistoric archæology into a succession of epochs included within the period of nonmetallurgic arts.

But before defining the archæological subdivisions of time it is indispensable to glance at the palæontological elements of the question, and the evidences they supply in relation to comparative chronology. One of the most remarkable phenomena affecting the conditions of life in Europe in recent geological epochs is the existence of a period, of long duration throughout the northern hemisphere, of a temperature resembling that of the Arctic regions at the present time. After a period more nearly approximating in its conditions the heat of the tropics at the present day, though otherwise under varying states towards the end of the tertiary epoch the temperature of the whole northern hemisphere gradually diminished, until the mountainous regions of Scotland and Wales—then probably of a much higher elevation—resembled Greenland at the present time; and this Arctic temperature gradually

extended southwards to the Alps and Pyrenees. The glaciers formed under the influence of perpetual frost and snow descended from those and other mountains into the valleys and plains over the greater portion of Central Europe and Northern Asia; and this condition of things, pertaining to what is known as the *glacial period*, was one of greatly prolonged duration.

After some partial modifications of this low temperature, and a consequent advance and retrocession of the glacial influences in France and elsewhere, along what was then the border lines of a north temperate zone, the glacial period drew to a close; a gradual but persistent rise of temperature carried the lines of ice and perpetual snow further and further northward, excepting in regions of great elevation, as in the Swiss Alps. This was necessarily accompanied by the melting of the vast glaciers accumulated in the mountain valleys throughout the protracted period of cold. The broken rocks and soil of the highlands were swept into the valleys by torrents of melted ice and snow; the lower valleys were hollowed out and re-formed under this novel agent; and the landscape received its present outlines of valley, estuary, and river-beds from the changes wrought in this *diluvian epoch*. The enormous power of the torrents thus acting continuously throughout a period of prolonged duration, and the vast deposits of sand, gravel, and clay, with the embedded remains of contemporaneous animal and vegetable life with which they everywhere covered the plains, were viewed till recently solely in relation to the Mosaic narrative of a universal deluge, and were referred implicitly to that source. But recent though the epoch is when compared with older geological periods, its antiquity is enormous in relation to historic chronology; and instead of being the product of a sudden cataclysm of brief duration, it represents phenomena which required a period of long protracted centuries for their evolution.

Within this late tertiary, or quaternary, period are found the remains of animal life contemporary with primeval man and his earliest arts. The very characteristics of some of the fossil animals of the period, so diverse from all that we have been accustomed to associate with man, help to suggest ideas of even an exaggerated antiquity for the era to which they are assignable, and to relegate it to the remotest conceivable antiquity consistent with all other evidence of the oldest traces of man or his arts seemingly contemporaneous with them. Of those now wholly extinct, the mammoth or *Elephas primigenius*, the *Elephas antiquus*, the *Rhinoceros tichorinus*, the *Hippopotamus major*, and such great cave carnivora as the *Ursus spelæus* and the *Felis spelæa*, are most noticeable for their great size, and in some cases for their enormous destructive powers, in striking contrast to the seemingly helpless condition of primitive man. Yet even some of those formidable mammalia probably owed their extinction fully as much to the presence of man as to any change in temperature and consequent alteration in the required conditions of climate and habitat. We are accustomed to regard the lion, tiger, leopard, panther, and others of the great *Felidae* as pertaining exclusively to tropical countries. They are in reality limited to tropical jungles and uncultivated regions of great extent, where the abundance of wild vegetable-feeding animals supplies their food. The existence of neither is compatible with the presence of man in any great numbers; but in his absence those beasts of prey greatly extend their range. The Indian tiger not only follows the antelope and deer in the Himalayan chain to the verge of perpetual snow, but the tiger, leopard, panther, and cheetah hunt their prey beyond that mountain range, even into Siberia.

The influence of man in the extirpation of the wild

fauna is illustrated by another class of extinct animals of many historical regions, which yet survive in more favorable localities. The discovery of abundant evidence of a period in the history of central and southern France when the reindeer (*Cervus terandus*) formed one of the chief sources both for the food of man and for the materials from which his weapons and implements were made, seems to carry us back to an era, inconceivably remote, when central France was in the condition of Lapland in mediæval or still earlier centuries. But the climate of North Britain is not even incompatible with the existence of the reindeer, and its favorite moss abounds in many parts of the Highlands. It need not therefore surprise us to learn that traces of the reindeer are by no means rare in Scotland; and numerous examples of its horns have recently been recovered in more than one Caithness locality, with the marks of sawing and cutting for artificial use, and lying among other remains in stone-built structures of a primitive population of North Britain. How old they are may not be strictly determinable, but they helped us to the acceptance of a very modern date for the presence of the reindeer there; for Torfæus states that so recently as the twelfth century the Jarls of Orkney were wont to cross the Pentland Firth to chase the roe and the reindeer in the wilds of Caithness. At the same date also we find the skin of the beaver rated for customs duties amongst articles of Scottish export specified in an Act of the reign of David I.

Another very characteristic animal pertaining to the pre-historic era of European man is the *Megaceros Hibernicus*, or gigantic Irish elk. Its bones occurred with those of the *Elephas primigenius*, the *Rhinoceros tichorinus*, the *Ursus spelæus*, and other extinct mammals, alongside of human remains and works of art, in the famous Aurignac cave of the Pyrenees, and in the recently-explored Brixham cave, on the Devonshire coast, similar remains of the fossil rhinoceros, horse, and reindeer, as well as of several extinct carnivora, lay embedded in the same breccia with flint knives. And not only have the horns and bones of the *Megaceros Hibernicus* been recovered from Irish bogs and marl-pits, with marks of artificial cutting, but a rude Irish lyre, found in the moat of Desmond Castle, Adare, has been pronounced by Professor Owen to be made from the bone of this extinct deer.

So is it with the ancient *Bovideæ*, not only adapted for the chase, but suitable for domestication; such as the *Bos primigenius*, the *Bos longifrons*, and the *Bison priscus*. Their remains have been found in submarine forests, or mingling in the drift or cave deposits with the *Elephas primigenius*, the *Felis spelæa*, and others of the most gigantic fossil mammals; while abundant traces reveal their existence not merely contemporaneous with man, but within definite historical periods.

The great alluvial valley of the river Forth has yielded another class of relics connecting the gigantic fossil mammalia of a prehistoric epoch with man. The disclosures of the Carse of Falkirk have repeatedly included remains of the *Elephas primigenius*: and in at least one case its tusks were found in such perfect condition as to be available for the ivory-turner, though lying embedded at a depth of 20 feet in the boulder clay. But in the neighboring valley of the Forth the fossil whale (*Balenoptera*) has not only been repeatedly found far inland, buried in the alluvial soil, at levels varying from 20 to 25 feet above high-water mark, but in at least two instances the rude lance or harpoon of deer's horn lay alongside of the skeletons; and near another of them were found pieces of stag's horn, artificially cut, and one of them perforated with a hole about an inch in diameter.

Flint implements, an oaken quern, and other ingenious traces of primitive art, recovered from the same alluvial soil, all tell of a time when the British savage hunted the whale in the shallows of a tide at the base of the Ochil hills, now between 20 and 30 feet above the highest tides and 7 miles distant from the sea.

There is no doubt that the disappearance of the whale from the British shores, like the reindeer from its northern valleys, is due far more to the presence of man than to any change of temperature so greatly affecting the conditions of life as to involve their extinction. Nevertheless it is convenient to recognise in the disappearance of such emigrant species from the historic areas the close of the palæontological age. The Urus, the Aurochs, the *Bos longifrons*, or native ox of the Roman period, and others of that important class of animals which man first began to turn to account for domestication, have also ceased to exist among European fauna; but this is clearly traceable to the destructive presence of man. Within three or four centuries the Urus (*Bos primigenius*) was still known in Germany; the Aurochs (*Bos priscus*) is even now preserved under special protection in Lithuania; and herds of British wild cattle in Cadzow forest, Lanarkshire, and at Chillingham Park, Northumberland, perpetuate varieties otherwise extinct.

Reverting, then, to the classification which prehistoric archaeology admits of, in the light of its most recent disclosures, it appears to be divisible into four distinct epochs, of which the first two embrace successive stages of the age of stone implements.

1. The *Palæolithic Period* is that which has also been designated the Drift Period. The troglodytes, or cave-dwellers, of this primitive era were to all appearance contemporaneous with the mammoth, the woolly-haired rhinoceros, and the great cave carnivora already named. In England, France, Belgium, and other countries of Europe, numerous caves have been explored which were undoubtedly the habitations and workshops of men of this period. These caverns vary in character and dimensions according to the geological features of the localities where they occur; but all alike involve the simple feature of recesses, more or less ample, affording comparatively dry and commodious shelter, and so being resorted to as places of habitation alike by wild animals and by man himself. But the most valuable for the purposes of the archæologist are a class of caverns which occur in limestone districts, and which, from the combined mechanical action of the water operating on a rock easily eroded, and its chemical action when charged with a certain amount of carbonic acid in dissolving the calcareous rock, are found expanded into long galleries and chambers of large dimensions. There the same chemical agents, acting under other circumstances, have dissolved the limestone rock, and sealed up the ancient flooring at successive intervals, thereby furnishing a test of the duration of long periods of alternate action and repose, and yielding evidence of the most indisputable kind as to the order of succession of the various deposits and their included bones and implements.

In Belgium, at Dordogne, and in some parts of the south of France, the caves and rock-recesses are of a much simpler character. Yet there also favoring circumstances have preserved contemporary deposits of the ancient cave-dwellers, their works of art, the remains of their food, and even their cooking hearths.

The caves of the drift period accordingly present peculiarly favorable conditions for the study of the post-pliocene period. Some of these caverns were evidently first occupied by the extinct carnivora of that period, as in the case of the famous Kent's Hole Cave of Devonshire, of which the lowest deposit is a breccia

of water-worn rock and red clay, interspersed with numerous bones of the *Ursus spelæus*, or great cave-bear. Over this a stalagmitic flooring had been formed, in some places to a depth of several feet, by the long-protracted deposition of carbonate of lime held in solution in the drippings from the roof. Above this ancient flooring, itself a work of centuries, later floods had superimposed a thick layer of "cave-earth," in some cases even entirely filling up extensive galleries with a deposit of drift-mud and stones, within which are embedded the evidences of contemporaneous life—bones and teeth of the fossil elephant, rhinoceros, horse, cave-bear, hyæna, reindeer, and Irish elk; and along with these, numerous weapons and implements of chipped flint, horn, and bone—the unmistakable proofs of the presence of man. These, again, have been sealed down, in another prolonged period of rest, by a new flooring of stalagmite; and thus the peculiar circumstances of those cave deposits render them specially favorable for the preservation of a coherent record of the period. Here are the evidences of the animal life contemporaneous with the men of the caves during the drift period; here also are many of their smaller flint implements—the flint-cores and the chips and flint-flakes, showing where their actual manufacture was carried on; and the lances, bodkins, and needles of bone, which could only have been preserved under such favoring circumstances.

But besides the actual deposits in the caves, the river gravels of the same period have their distinct disclosures. The spear-heads, discs, scrapers, and other large implements of chipped flint are of rare occurrence in the cave breccia. Their size was sufficient to prevent their being readily dropt and buried beyond reach of recovery in the muddy flooring of the old cave dwelling; and the same cause preserved them from destruction when exposed to the violence involved in the accumulation of the old river drifts. In the north of France, and in England from Bedfordshire southward to the English Channel, in beds of ancient gravel, sand, and clay of the river valleys, numerous discoveries of large flint implements have been made—from the year 1797, when the first noted flint implements of the drift were discovered in the same stratified gravel of Hoxne, in Suffolk, in which lay the bones of the fossil elephants and other extinct mammalia. The characteristics of the river-drift implements, as well as of the whole art of the stone age, have been minutely described and illustrated in various works, but especially in Evans's *Ancient Stone Implements, Weapons, and Ornaments of Great Britain*. It is sufficient, therefore, to refer to such authorities for details.

But besides the numerous specimens of the manufactures in flint, horn, and bone, illustrative of the mechanical ingenuity of this primitive era, special attention is due to the actual evidences of imitative and artistic skill of the sculptors and draughtsmen of the same period.

2. This first or palæolithic period, with its characteristic implements of chipped flint, belonging to an epoch in which man occupied central Europe contemporaneously with the mammoth, the cave-bear, and other long-extinct mammals, was followed by the second or *Neolithic Period*, or, as it has been sometimes called, the Surface-Stone Period, in contradistinction to the Drift Period, characterised by weapons of polished flint and stone. The discovery and exploration of the ancient *Pfahlbauten* or lake villages of Switzerland and other countries, including the crannoges of Ireland and Scotland, and of the *kjökken-møddings* or refuse-heaps of Denmark, Scotland, and elsewhere, have greatly extended the illustrations of this period, and given definiteness to

the evidences of its antiquity. But while it thus includes works of a very remote epoch, it also embraces those of later regular sepulture, with the sepulchral pottery of rudest type, the personal ornaments and other remains of the prehistoric races of Europe, onward to the dawn of history. It even includes the first traces of the use of the metals, in the employment of gold for personal adornment, though with no intelligent recognition of its distinction from the flint and stone in which the workmen of this neolithic period chiefly wrought.

Elaborately-finished axes, hammer-heads, cups, and vases of the late neolithic era serve to illustrate the high stage to which the arts of a purely stone period could be advanced, in the absence of any process of arrestment or change. But long before such a tendency to development into ornamental detail and symmetrical regularity of construction could be brought to bear on the megalithic architecture of the same era, the metallurgic sources of all later civilisation had begun to supersede its rude arts. To such remote eras we strive in vain to apply any definite chronology. At best we work our way backwards from the modern or known into the mysterious darkness of remotest antiquity, where it links itself to unmeasured ages of geological time. But by such means science has been able to add a curious chapter to the beginnings of British and of European story, involving questions of mysterious interest in relation to the earliest stages in the history of man. The very characteristics which distinguished him in his rudest stage from all other animals have helped from remotest times to perpetuate the record of his progress.

The source of change in Britain, and throughout Europe, from this rude state of barbarism, is clearly traceable to the introduction of metals and the discovery of the art of smelting ores. Gold was probably the earliest metal wrought, both from its attractive appearance, and from its superficial deposits, and the condition in which it is frequently found, rendering its working an easy process. Tin also, in the south of Britain, was wrought at the very dawn of history: and, with the copper which abounds in the same district of country, supplied the elements of the new and important compound metal, bronze.

3. This accordingly indicates the transition from the later stone age to the third or *Bronze Period*, which, beginning apparently with the recognition of the native copper as a malleable metal, and then as a material capable of being melted and moulded into form by the application of ores so as to extract the metal, and that of mixing metals in diverse proportions so as to prepare an alloy of requisite ductility or hardness, according to the special aims of the artificer.

Along with the full mastery of the working in copper and bronze the skill of the goldsmith was correspondingly developed; and the ornaments of this period, including tarques, armlets, beads, and other personal decorations and insignia of office, wrought in gold, are numerous, and often of great beauty. The pottery of the same period exhibits corresponding improvement in material, form, and ornamentation; though, considering the mimetic and artistic skill shown in the drawings and carvings of the remotest periods, it is remarkable that the primitive pottery of Europe is limited, alike in shape and decoration to purely arbitrary forms. This in its crudest conventionalism consists almost exclusively of varieties of zigzag patterns scratched or indented on the soft clay. This primitive ornamentation seems so natural, as the first æsthetic promptings of the human mind, that it is difficult, if not in some cases impossible, to distinguish between the simple pottery of comparatively recent origin, recovered on the sites of

old American Indian villages, and primitive pottery obtained from British barrows pertaining to centuries long prior to the Christian era. But the fictile ware exhibits an improvement in some degree corresponding to that of the metallurgic art, which everywhere throughout Europe furnishes weapons, implements, and personal ornaments of the bronze period, characterised by much grace and delicacy in form, and by an ornamentation peculiar in style, but not unworthy of the novel forms and material.

In reviewing the characteristics of this bronze period, the disclosures of native art on the American continent supply some singularly interesting and suggestive illustrations. There, throughout the whole northern region of the North American continent and in the ruder areas of South America, as well as in the West Indian archipelago, a population was found consisting exclusively of rude nomad hunters, in a pure stone period of primitive savage art. Nor does it at all conflict with this that they were to a certain extent familiar with the resources of the rich copper regions of Lake Superior, where that metal is found in enormous masses in a malleable state. This they procured, and not only themselves employed it in the manufacture of weapons, implements, and personal ornaments, but distributed it by barter far down the Ohio and Mississippi valleys, and eastward to the great lakes, to the St. Lawrence valley, and to the Hudson river. Silver and lead are also found in the same rich mineral region in metallic crystals, and were not unknown to the native tribes. But everywhere those metals were cold-wrought, as a mere malleable stone capable of being hammered into any desired shape, but in total ignorance of the influence of fire or the use of alloys.

But wholly distinct from its rude Indian tribes, North America had its semi-civilised Mexicans and South America its more highly civilised Peruvians, who had learned to mine and smelt the ores of the Andes, and make metallic alloys wherewith to fashion for themselves bronze tools of requisite hardness for quarrying and hewing the solid rock. With these they sculptured the statues of their gods, and reared palaces, temples, and pyramids, graven with elaborate sculptures and hieroglyphics by a people wholly ignorant of iron, which have not unjustly suggested many striking analogies with the megalithic art of ancient Egypt. The *huacas*, or tombs of the Incas of Peru, and also their royal depositories of treasure, have disclosed many remarkable specimens of elaborate metallurgic skill, — bracelets, collars, and other personal ornaments of gold; vases of the same abundant precious metal, and also of silver; mirrors of burnished silver, as well as of obsidian; finely-adjusted silver balances; bells both of silver and bronze; and numerous common articles and tools of copper, or of the more efficient alloy of copper and tin, — all illustrative of the arts and civilisation of a purely bronze age.

4. The fourth or *Iron Period* is that in which the art of smelting the ores of the most abundant metal had at length been mastered; and so iron superseded bronze for arms, sword-blades, spear-heads, axes, daggers, knives, &c. Bronze, however, continued to be applied to many purposes of personal ornament, horse furniture, the handles of swords and other weapons; nor must it be overlooked that flint and stone were still employed for lance and arrow-heads, sling-stones, and other common purposes of warfare or the chase, not only throughout the whole bronze period, but far into the age of iron. The discovery of numerous arrow-heads, or black flint, on the plain of Marathon, has been assumed with good reason to point to the use of such rude weapons by the barbarian host of Darius; and the infer-

ence is confirmed by the facts which Herodotus records, that Ethiopian auxiliaries of the army of Xerxes, ten years later, were armed with arrows tipped with stone.

The essential change resulting from the maturing of the iron period lies in the unlimited supply of the new metal. Had bronze been obtainable in sufficient quantity to admit of its application to the endless purposes for which iron has since been employed, the mere change of metal would have been of slight significance. But the opposite was the case. The beautiful alloy was scarce and costly; and hence the arts of the neolithic period continued to be practised throughout the whole duration of the age of bronze. But iron, though so abundant in its ores, requires great labor and intense heat to fuse it; and it needed the prolonged schooling of the previous metallurgic era to prepare the way for the discovery of the properties of the ironstone, and the processes requisite to turn it to account. Iron, moreover, though so abundant, and relatively of comparatively recent introduction, is at the same time the most perishable of metals. It rapidly oxidises unless protected from air and moisture, and hence few relics of this metal belonging to the prehistoric period have been preserved in such a state as to illustrate the skill and artistic taste of the fabricators of that last pagan era, in the way that the implements of the three previous periods reveal to us the habits and intellectual status of those older times.

But the iron is the symbol of a period in which pottery, personal ornaments of the precious metals, works in bronze, in stone, and other durable materials, supply ample means of gauging the civilisation of the era, and recognising the progress of man in the arts, until we come at length to connect their practice with definite historical localities and nations, and the names of Egypt and Phœnicia, of Gadir, Massilia, the Cassiterides, and Noricum, illuminate the old darkness, and we catch the first streak of dawn on a definite historical horizon. Thus, with the mastery of the metallurgic arts is seen the gradual development of those elements of progress whereby the triumphs of civilisation have been finally achieved, and man has advanced towards that stage in which the inductive reasonings of the archaeologist are displaced by records more definite, though not always more trustworthy, as the historian begins his researches with the aid of monumental records, inscriptions, poems, and national chronicles.

Within the later iron period, accordingly, we reach the era of authentic history. There is no room for doubt that, whatever impetus the Roman invasion may have given to the working of the metals in Britain, iron was known there prior to the landing of Julius Cæsar. Within this archæological period, however, the examples of Roman art and the influence of Roman civilisation begin to play a prominent part. To this period succeed the Saxon and Scandinavian eras of invasion, with no less characteristic peculiarities of art workmanship, as well as of sepulchral rites and social usages. In these later periods definite history comes to the aid of archæological induction, while those intermediate elements of historical re-edification, the inscriptions on stone and metal, and the numismatic series of chronological records, all unite to complete a picture of the past, replete with important elements for the historian.

That man has everywhere preceded history is a self-evident truth. So long as no scientific evidence seemed to conflict with a long-accepted chronology in reference to the antiquity assigned to the human race, it remained unchallenged, though the like computation had been universally rejected in reference to the earth as the theatre of his history, and we were content to regard the prehistoric era of man as no more than a brief infancy of the

race. But the investigations and disclosure of recent years in reference to the whole prehistoric period have involved of necessity a reconsideration of the grounds on which a definite antiquity of comparatively brief duration has been assigned to man; and the tendency at present is rather to exaggerate than diminish the apparent antiquity of the race. The nature and extent of the evidence which has thus far rewarded intelligent research have been sufficiently indicated above; and as it is still far from complete, the student of archæology will act wisely in pushing forward his researches, and accumulating and comparing all available evidence, without hastily pronouncing any absolute verdict on the question. But, without attempting to connect with any historic chronology the men of the English drift, or the troglodytes of the mammoth or reindeer periods of France, it may be useful, in concluding summary of primitive archæology, to glance at the origin of civilization, and the evidences of antiquity of what appear to constitute its essential elements.

Everywhere man seems to have passed through the same progressive stages: First, that of the *savage* or purely *hunter state*: a condition of precarious instability, in which man is most nearly in the state of a mere animal subsisting on its prey. It is the condition of nomad life, incompatible with a numerous or settled population; exhausting the resources of national being in the mere struggle for existence, and therefore inimical to all accumulation of the knowledge and experience on which human progress depends. In this primitive state, man is disclosed to us by the evidence with which the archaeologist now deals. He appears everywhere in this first stage as the savage occupant of a thinly-peopled continent, warring with seemingly inadequate means against gigantic carnivora, the contemporary existence of which is known to us only by the disclosures of geological strata or ossiferous caves, where also the remains of still more gigantic herbivora confirm the idea of man's exhaustive struggle for existence. The nearest analogy to such a state of life is that of the modern Esquimaux, warring with the monstrous polar bear, and making a prey of the gigantic cetaceæ of Arctic seas. Through how many ages this unhistoric night of European man may have preceded the dawn of civilization it is at present vain to speculate. But this is noticeable, that there is no inherent element of progress in a people in the condition of the Esquimaux. To all appearance, if uninfluenced by external impulse, or unaffected by any great amelioration of climate, they are likely to prolong the mere struggle for existence through unnumbered centuries, armed, as now, with weapons ingeniously wrought of bone, ivory, and stone, the product of the neolithic arts of this 19th century.

To this succeeds the second or *pastoral state*, with its flocks and herds, its domesticated animals, and its ideas of personal property including in its earlier stages that of property in man himself. It pertains to the open regions and warmer climates of the temperate zone, and to the elevated steppes and valleys of semi-tropical countries, where the changing seasons involve of necessity the wandering life of the shepherd. This accordingly prevents the development of the arts of settled life, especially those of architecture; and precludes all idea of personal property in the soil. But the conditions of pastoral life are by no means incompatible with frequent leisure, reflection, and consequent intellectual progress. Astronomy has its origin assigned to the ancient shepherds of Asia; and the contemplative pastoral life of the patriarchs Job and Abraham has had its counterpart in many an Arab chief of later times.

The third or *agricultural stage* is that of the tillers of the soil, the Aryans, the ploughers and lords of the

earth, among whom are developed the elements of settled social life involved in the personal homestead and all the ideas of individual property in land. The process was gradual. The ancient Germans, according to the description of Tacitus, led the life of agricultural nomads; and such was the state of the Visigoths and Ostrogoths of later centuries. But this was in part due to the physical conditions of trans-Alpine Europe in those earlier centuries. Long ages before that, as the ancient Sanscrit language proves, the great Aryan family, of which those are offshoots, had passed from the condition of agricultural nomads to that of lords of the soil among a settled agricultural people. They had followed up the art of ploughing the soil with that of ship-building and "ploughing" the waves. They were skilled in sewing, in weaving, in the potter's art, and in masonry. Their use of numbers was carried as high at least as a hundred before they settled down from their nomad life. They had domesticated the cow, the sheep, the horse, and the dog; and their *pasu* or feeders already constituted their *pecus*, their wealth, before the *pecunia* assumed its later forms of currency. They had also passed through their *bronze* and into their *iron* period; for their language shows that they were already acquainted with the most useful as well as with the most valuable grains.

The whole evidence of history points to the seats of earliest civilisation in warm climates, on the banks of the Nile, the Euphrates, the Tigris, the Indus, and the Ganges. The shores of the Mediterranean succeeded in later centuries to their inheritance, and were the seats of long-enduring empires, whose intellectual bequests are the life of all later civilisation. But trans-Alpine Europe, which is now yielding up to us the records of its prehistoric ages, is entirely of modern growth so far as its historic civilisation is concerned, and wherever it extends toward the northern verge of the temperate zone it is even now in its infancy. Here, then, we trace our way back to the first progressive efforts of reason, and find man primeval, in a state of nature, in the midst of the abundance pertaining to a genial and fertile climate, which rather stimulates his æsthetic faculty than enforces him by any rigorous necessity to cultivate the arts for the purposes of clothing and building. Thus employing his intellectual leisure, he begins that progressive elevation which is as consistent with his natural endowments as a rational being as it is foreign to the instincts of all other animals. He increases and multiplies, spreads abroad over the face of the earth, clears its forests, drains its swamps, makes its rivers and seas his highways, and its valleys and plains his fertile fields and pasture-grounds. Cities rise, with all the fostering influences of accumulated wealth and settled leisure, and with all the stimulating influences of acquired tastes and luxurious desires. The rude pictorial art—not ruder on the graven ivory of the troglodytes of the Madelaine cave than on many a hieroglyphic drawing of the catacombs and temples of Egypt—employed in picture-writing, passes by a natural and inevitable transition from the literal representations of objects to the symbolic suggestion of ideas, to a word-alphabet, and then to pure phonetic signs. The whole process is manifest from the very infancy of Egyptian picture-writing, as crude as that with which the Indian savage still records his deeds of arms on his buffalo-robe, or carves the honors of the buried warrior on his grave-post. Letters lie at the foundation of all high and enduring civilisation, yet we can thus trace them back to their infantile origin; and so onward in their slow transformations, as in the mingled pictorial and phonetic writing of the Rossetta stone hieroglyphics of the age of the Ptolemies.

Through Phœnician, Greek, and Roman modifications,

they have come down to us as the arbitrary symbols of sounds which the voice combines into articulate speech.

And as it is with letters so it is with man's *arts*,—his drawing, carving, sculpture, architecture, weaving, pottery, metallurgy; and so with his *science*,—his astrology, astronomy, geometry, alchemy, and all else. The beginnings of all of them lie within our reach. We can trace back the measurements of solar time to the crudest beginnings of more than one ancient nation, with a year of 360 days. This, corrected to the definite approximation to the true solar year of a period of 365 days, became the vague year of the Egyptians, with the great Sothiac cycle of 1460 years, clearly pointing to a system of chronology which could not have been perpetuated through many centuries without conflicting with the most obvious astronomical phenomena as well as with the recurring seasons of the year.

Man is, after all, according to the boldest speculations of the geologist, among the most modern of living creatures. If indeed the theory of evolution from lower forms of animal life is accepted as the true history of his origin, time may well be prolonged through unnumbered ages to admit of the process which is to develop the irrational brute into man. But regarding him still as a being called into existence as the lord of creation, endowed with reason, the demonstration of a prolonged existence of the race, with all its known varieties, its diversities of language, and its wide geographical distribution under conditions so diverse, tends to remove greater difficulties than it creates. No essential doctrine, or principle in morals, is involved in the acceptance or rejection of any term of duration for the human race; and the idea of its unity, which for a time was scornfully rejected from the creed of the ethnologist, is now advocated by the evolutionist as alone consistent with the physical, mental, and moral characteristics common to savage and civilized man, whether we study him amid the traces of palæolithic osteology and arts, or among the most diverse races of living men.

The process of research and inductive reasoning thus applied by the archæologist to the traces of primitive art and the dawn of civilisation, is no less applicable to all periods. The songs and legends of the peasantry, the half-obliterated traces of ancient manners, the fragments of older languages, the relics of obsolete art, are all parts of what has been fitly styled "unwritten history," and furnish the means of recovering many records of past periods which must remain for ever a blank to those who will recognise none but written or monumental evidence.

Proceeding to the investigation of this later and, in most of the higher requirements of history, this more important branch of historical evidence, the archæologist has still his own special departments of investigation. Tracing the various alphabets in their gradual development through Phœnician, Greek, Roman, and other sources, and the changing forms which followed under the influences of Byzantine and mediæval art, a complete system of palæography has been deduced, calculated to prove an important auxiliary in the investigation of monumental and written records. Palæography has its own rules of criticism, supplying an element of chronological classification altogether independent of style in works of art, or of internal evidence in graven or written inscriptions, and a test of genuineness often invaluable to the historian.

Architecture, sculpture, and pottery have each their historical value, their periods of pure and mixed art, their successions of style, and their traces of borrowed forms and ornamentation, suggestive of Indian, Assyrian, Egyptian, Phœnician, Punic, Greek, Etruscan, Roman,

Arabian, Byzantine, Norman, or Renaissance influences subordinate to those are the pictorial arts combined with sculpture and pottery, from earliest Egyptian, Greek or Etruscan art to the frescoes and paintings of mediæval centuries; and the rise of the art of the engraver, traceable through ancient chasing on metals, mediæval niello-work, graven sepulchral brasses, and so on to the wood blocks, whence at length the art of printing with movable types originated. And as in the Old World so in the New, the progress of man is traceable from rudest arts of stone and copper to the bronze period of Mexico and Peru, where also architecture, sculpture, and pottery preserve for us invaluable materials for the elucidation of that prehistoric time which only came to an end there in the year 1492 A. D.

Heraldry is another element by means of which archaeology provides trustworthy canons of criticism in relation to written and unwritten mediæval records. The seals and matrices, sepulchral sculptures, and engraved brasses, along with an extensive class of the decorations of ecclesiastical and domestic architecture, all supply evidence whereby names and dates, with confirmatory collateral evidence of various kinds, are frequently recoverable. From the same sources also the changing costume of successive periods can be traced, and thus a new light be thrown on the manners and customs of past ages. The enthusiastic devotee is indeed apt at times to attach an undue importance to such auxiliary branches of study; but it is a still greater excess to pronounce them valueless, and to reject the useful aids they are capable of affording.

No less important are the illustrations of history, and the guides in the right course of research, which numismatics supplies, both in relation to early and mediæval times. But on this and other sections into which the study of antiquities is divided, the requisite information will be found under the several heads of research. On many of those points the historian and the archaeologist necessarily occupy the same field; and indeed, when that primitive period wherein archaeology deals with the whole elements of our knowledge regarding it, as a branch of inductive science, and not of critical history, is past, the student of antiquities becomes to a great extent the pioneer of the historian. He deals with the raw materials: the charters, deeds, wills, grants of land, of privileges or immunities, the royal, monastic, and baronial accounts of expenditure, and the like trustworthy documents; by means of their palæography, seals, illuminations, and other evidence, he fixes their dates, traces out the genealogical relationships of their authors, and in various ways prepares and sifts the evidence which is to be employed anew by the historian in revivifying the past. Architecture and all departments of the fine arts, in like manner, supply much evidence which, when investigated and systematised by a similar process, adds valuable materials to the stock of the historian, and furnishes new sources for the illumination of past ages. Such is a sketch of the comprehensive investigations embraced under the name of archaeology, which, carried on by many independent laborers, and in widely varied fields of research, have contributed important chapters of human history, and revived ages long buried in oblivion, or at best but dimly seen through distorting media of myth and fable.

CLASSICAL ARCHÆOLOGY.—The province of classical archaeology is to investigate and determine the results of artistic activity among the Greeks and Republic of Bolivia. The boundary to the W. is formed by the mountain chain of the Andes. The southern limit, for some time a question in dispute with the Government of Chili, was determined by treaty concluded at

the other extreme of the simplest object shaped for a purpose by human hands. A stone, rudely hewn with some design, an artificial tumulus, and common clay utensil, each represent in a humble fashion, a thought artistically expressed in substance, and each reflect more or less accurately the artistic spirit of the time at which they were made. It ranges also from the earliest examples of workmanship down through the historical periods of development and decline. So far classical archaeology may properly be called a section of the general history of art. It owes its independent position entirely to the peculiar circumstances under which its investigations are conducted. For example, when called upon to determine the date of an inscription from the forms and disposition of its letters, which, as works of art, must reflect the taste of the period in which they were incised, it has to bring to bear on the question a knowledge of palæographical eccentricities. Or when the date of a coin has to be fixed, the standard on which it has been struck and the historical circumstances connected with it must be taken into consideration. Such, at least, is the practice of journals and societies devoted to classical archaeology. On the other hand, recent writers desire to confine these collateral inquiries to within the narrowest possible limits. They have agreed to dismiss altogether mythological researches, which in Gerhard's time formed one of the principal occupations of archaeologists. Most of them consent to epigraphy being classed under philology. With regard to numismatics, however, opinions are still divided as to whether it should be included under archaeology, on the ground of the immense importance of coins as monuments of art, or whether, on account of their historical value, the study of them should be classed under philology. A similar question has been raised regarding topography.

The discovery of Herculaneum in 1720 and of Pompeii in 1748 opened a new era in the history of archaeology. The antiquarian spirit gave way to an historical and scientific method, of which Count Caylus may be regarded as the forerunner, and Winckelmann (1717-1768) as the actual founder.

The rapid and vast accumulation of new material after the time of Winckelmann required a new informing spirit. The first to assume this function was Thiersch, in three articles, "Ueber die Epochen der bildenden Kunst unter den Griechen," 1816, 1819, 1825, in which he endeavored to prove the influence of the Egyptians and Phenicians on early Greek art. Against him appeared K. O. Müller, denying altogether an exotic influence, and comparing the development of Greek art to the organic development of plants, its various periods being coincident with the marked periods of political history.

First Period.

The oldest remains of workmanship in Greece, if we except the series of stone implements discovered within the last few years in various localities, are the ruined walls of Tirynth and several other ancient citadels, the stupendous masonry of which, together with the primitive manner of construction by means of unhewn polygonal blocks of immense size, led the later Greeks to believe that they had been the work of a mythical race of giants, Cyclopes, and to designate such masonry as Cyclopean. Instead of the unsatisfactory Cyclopes, the Pelasgians, who preceded the Greeks in the occupation, which numerous volcanoes, many of them still active, have ejected vast quantities of lava and scorixæ. Along most parts of the great mountain chain there are three subsidiary and more or less parallel ridges, between

what relation of blood this race may have stood to the Greeks who succeeded them cannot be determined, but it is known that the Greeks adopted from them, among other religious beliefs and rites, those of Dodona; and since even this primitive style of masonry commended itself to them for a time, the Pelasgians must be regarded as having in some degree assisted in the artistic progress of their successors. The walls of Mycenæ furnish an example of the fine skill with which the Greeks afterwards employed the Pelasgic construction, the blocks of stone being carefully jointed and hewn on the outer surface, while the interior of the wall is filled up with mortar and small stones. Mycenæ claimed to be one of the very oldest towns of Greece, and its walls may fairly be regarded as the oldest known monument of Greek workmanship.

Of the connection which is assumed to have existed between the earliest monuments of Greek art and the contemporary art of Assyria, evidence is cited from remains of undoubtedly early workmanship in the countries of Asia Minor, Lycia, Lydia, and Phrygia, of which the two latter were intimately associated with the oldest traditions and religious beliefs of Greece. The peculiar feature of Lycian art is its tombs cut in the rock, of which the oldest class are direct imitations of wooden structures such as we may conceive the primitive temples of an Oriental race to have been. In Phrygia we have another class of rock-cut tombs of very remote antiquity, of which that of Midas (Semper, *Der Stil*, i. p. 429) is the best preserved example. Here the style of decoration is obviously derived from Assyrian tapestry. In Lydia we have tombs again, but they are in the form of immense tumuli,—as, for instance, that of Alyattes near Sardis, which astonished Herodotus by its size, being 1300 feet in diameter at the base, and over 250 feet high. Similar tumuli occur among the old Chaldeans.

With the immigration of the Dorian race commenced the development of an independent style of architecture in Greece, the first step apparently being the invention of a house supported by columns as the design for a temple. About the same time originated also, it is supposed, the Ionic order, which though presenting a certain Asiatic richness of ornament strongly opposed to the severe simplicity of the Doric, was still a pure Greek invention. With the new movement in architecture a fresh impetus was given to the art of sculpture. At first the reports sound somewhat fabulous,—as, for example, that in which Butades the Corinthian potter is described as having hit on the idea of modelling a face in clay and baking it along with his vases. Butades himself, however, is an historical person, and Corinth is known to have been a flourishing seat of potters and other artists as early as the time of the tyrant Cypselus (650 B.C.), through whose oppression it is said the artists, Eucheir, Diopus, and Eugrammus emigrated to Etruria, which afterwards became celebrated for its sculptures in terracotta. But the most remarkable specimen of early sculpture, presumably Corinthian, was the chest in which the infant Cypselus was concealed, and of which a detailed description is given by Pausanias. The chest, itself of cedar, was ornamented with a wealth of figures in gold and ivory, arranged in parallel horizontal bands, and representing heroic legends and scenes from daily life, the names of the individual figures being inscribed in the manner characteristic of early times, and in what Pausanias calls very ancient letters. Glaucus is said to have discovered the art of welding iron (692 B.C.), the substitute for which had previously been nails. At this period we have frequent mention of splendid metal utensils, as, for instance, the enormous cauldron, with projecting gryphons' heads and a support formed of kneel-

ing figures, seven ells in height. As the oldest example of sculpture in bronze which he had seen, Pausanias describes a statue of Jupiter at Sparta, the work of Clearchus of Rhegium, whom some called a pupil of Dædalus. It was made of plates of bronze, beaten out to express the whole figure, and then fastened together with fine nails, the arts of soldering and of casting being still unknown. Of sculpture in this manner we possess only one example, the bronze bust found at Polledrara, near Vulci, and now in the British Museum.

Second Period.

Until the invention of casting in bronze the Greek sculptors continued to work in relief except when images were required for the purposes of worship, and that in these cases, whether the figure was of wood, stone or bronze, the rude helpless form of ancient times was preserved. Stimulated, it may be supposed, by the achievements of the newly-invented art, sculptors now began to look to the possibility of producing in marble also a resemblance to the human figure in its substantial roundness. The scene of the first success in this direction was Chius, where a family which for three generations (Melas, Micciades, and Archermus) had been celebrated for its workers in marble, was at this time represented by the brothers Bupalus and Athenis.

The school of Chius had a rival in that of Magnesia on the Mæander, at the head of which was Bathycles, whose fame is associated with the reliefs and figures on the colossal throne of Apollo at Amyclæ. He and a number of his pupils or assistants had been purposely invited to the task, and what they accomplished was probably the best that could then be done, however short of the standard of later times it may have fallen in the eyes of Pausanias. One noticeable fact is, that after completing their work, they left behind portraits of themselves, and this, in connection with the portrait of Hipponax, may serve to show that sculptors had already begun to direct their attention to the individual features of the human face.

The new phase of art thus entered on, according to tradition, by the Ionians, was now taken up vigorously by the Doric sculptors, among whom the first to attain distinction were Dipœnus and Scyllis, natives of Crete, and members of the ancient guild of sculptors there, which took its name from the mythic Dædalus.

In the earlier part of our period it is to be observed that the Dorian race still continued to furnish the sculptors of distinction, but the main centers of the art were now in the Peloponnesus instead of the islands. In Sicyon the reputation acquired by Dipœnus and Scyllis was enlarged by Canachus, whose works were spoken of in later times as models of the severe restrained style of the early schools.

The schools of Argus and Ægina appear to have mostly confined themselves to working in bronze. At the head of the former stood Ageladas, whose principal reputation consists in his having been the instructor of the three great masters, Myron, Polyclethus, and Phidias. Nine of his works are mentioned, including two statues of Zeus, but no description of his style is added, nor is anything regarding it to be inferred from the very diverse manner of his three great pupils. His date falls between 508 and 452 B.C.

In Athens we find in this period Endœus, of whom the scanty records permit us to know almost nothing, and Antenor, the author of a bronze group representing the Tyrannicides, Harmodius and Aristogiton, and erected in the Agora at the foot of the Acropolis. That these figures were executed shortly after the incident which they were intended to commemorate, 550 B.C., is very probable.

At Rhegium, in lower Italy, the mantle of Clearchus had fallen on Pythagoras, unless it be true, as is also stated, that he had received his instruction from an otherwise unknown artist, Euchirus of Corinth. A list of the sculptures by Pythagoras shows that he worked exclusively in bronze, that his subjects, with the exception of a group of Europa on the bull, in Tarentum, consisted of male figures, and these of a kind in which either a strongly-pronounced muscular action, or a marked capacity for it, must have been expressed. The most famous of them was his statue of Philoctetes at Syracuse, of which the epigram writers declared that the expression of pain in it was such as to move the spectator.

We have seen how few of the existing monuments can be traced even conjecturally to the artists of this early period, whose names and praises have been handed down to us. Monuments of sculpture there are, manifestly assignable to this period, and some of them worthy of the fame of a great master. But whether the men who executed them were unhonored in their time, or whether from the insufficiency of our literary records names well known in antiquity may have escaped us, or whether, in fact, the best of these works at least may really have come from the hands of men otherwise well known, remains unexplained. The last-mentioned possibility has been placed in a strong light by Brunn's discussion on the sculptures from the temple of Athene at Ægina, now in Munich. Not that he would trace them directly to the hands of the artists Callon and Onatas of Ægina. What he aims at is to connect the characteristics of the sculptures intimately with the style recorded of these two men, and to leave the rest for conjecture. Of the figures in the western pediment, in which the combat over the dead body of Achilles was represented, only one is lost. From the eastern only five complete figures remain. The subject of it was a combat corresponding in its main features with that of the other pediment. In both the central object of the strife is a fallen hero; in both the goddess Athene appears on the scene. In the one group her figure is entire; in the other only her head remains. In the eastern pediment the only recognisable figure is that of Hercules, and from his presence it has been supposed that the subject of the composition was the combat of that hero and Telamon against Laomedon of Troy. The statues of this pediment are of a bolder and more advanced style than the others, from which it has been inferred that they may have been the work of a younger man, carried away by a new movement in art, while the others may have been the work of an older artist, hardened in the traditions of his school. One thing, however, is plain from the remarkable uniformity which reigns among the figures of both groups, that the artist or artists had hitherto been limited in their study to one type of the human form, and that the nude form of finely-developed athletes. Nowhere is there individuality, but everywhere an excessive carefulness in rendering the forms. The goddess Athene has all the rigidity of the ancient figures intended for a worship which little brooked innovations. The expression on the faces is throughout the same, and the hair is always rendered in one conventional manner. The figures are spare and hard, with as little flesh as possible. In both pediments the scene — a combat over a fallen hero — is intended to stir our sympathy, but entirely fails. There is no straining of muscles, no expression of grief, and no sense of the emergency. We turn from the figures as a whole to the pleasing truthfulness with which the parts are rendered. To give them a greater air of vitality, the lips and eyes of the statues, with such accessories as drapery, sandals, and weapons, were originally colored blue and red, while many small holes remain to show that part of the armour and ægis on the breast of Athene had been attached in

metal, a fact which bears with great importance on the question of the polychromy of ancient statues. With regard to the date of these sculptures, the opinion is that they could hardly have been executed more than fifty years before the time of Phidias (engraved, Müller, *Denkmäler*, i. pls. 6-8).

If we are to credit the Greeks with having been introduced by the Assyrians to one branch of art more than another, we should say it was the art of gem-engraving. Not that we possess Greek gems which compare in style and antiquity with those of Assyria, but, if for no other reason, because we find a technical process of so great difficulty existing at all in Greece at an early period.

Painting, or rather coloring, as it would be more properly described in its earliest phase, in which it was entirely subservient to architecture and ceramography, is said to have been first elevated to an art by Cleantes of Corinth, who introduced the drawing of figures in outline; by Telephanes of Sicyon, who improved on this by indicating the principal details of anatomy; and finally by Ecphantos of Corinth or Craton of Sicyon, by the introduction of colors. Again we have Eumarus of Athens, who is said to have first distinguished in his paintings men from women, probably by the means adopted in the early vases, that is, by painting the flesh white in the case of women. The historical truth of these statements may be doubted; not so, however, those that refer to Cimon of Cleonæ, who made an unquestionable advance in the treatment of draperies, and in exchanging the conventional manner of rendering the human form for an approach to truthfulness to nature. Cimon appears to have been the founder of the early Peloponnesian school of painting. As the task imposed on painters at that time was mostly the decoration of the cella walls of temples, we must suppose that they executed their paintings on the prepared stucco of the wall either when it was fresh, or when it was dry, by means of some binding material. Like their followers down to the time of Apelles, they used only the simple colors, white, yellow, red, and bluish black, in the mixing of which to obtain other shades they seem to have advanced very little, greater attention being directed to the drawing than to the coloring. The other colors employed are white for the flesh parts of women and the hair of old men, white and a dark purple for the details of draperies and other accessories. The eyes are always placed full in profile, and the drawing of the figures is exceedingly stiff and angular.

In temple architecture the principles of both the Doric and Ionic orders were already fully established, the latter in Asia Minor and the former in Greece proper; and it is characteristic of the national importance attached to this branch of art, that not only was the best available talent of the time procured, irrespective of local connection, but also that architects appear to have found a public for the writings in which many of them narrated their proceedings, and described the appliances used by them in building, as did Chersiphron and his son Metagenes in regard to the temple of Diana at Ephesus; or laid down the principles they had followed, as did Theodorus with regard to the temple of Hera at Samus. Among the remains of Doric architecture assignable to this period, the first to be mentioned are the two temples at Pæstum (Major, *Les Ruines de Pæstum ou de Posidonie*, 1768; cf. Schnaase, *Bildende Künste*, ii. fig. 36), of which the larger derives a special interest from the two rows of columns, one above the other, with which it is furnished in the interior, for the purpose of supporting, as it appears, a hypæthral roof. The oldest instance of the Ionic order in Greece proper, so far as we know, was found in the

treasury erected at Olympia by Myron, the tyrant of Sicyon, after his chariot victory, 658 B.C. This building consisted of two chambers, the walls overlaid in the ancient manner with bronze plates, and the one executed in the Ionic, while the other was of the Doric order. The architects of this early time were not, however, restricted to the erection of temples, but had other problems to solve, as, for example, in the Scias of Sparta, a round building with tent-shaped roof, used originally for musical performances and afterwards for public assemblies. Theodorus of Samus was the architect of the Scias. Probably the Odeum erected at Athens by Solon or Pisistratus had the same round form, and was intended for meetings of the same kind. Then followed the construction of theatres, that in Athens, which was of stone, having been commenced shortly after 500 B.C.

Third Period.

The splendid victories of Salamis, Plateæ, and Mycale, gave an immediate and powerful impulse towards public undertakings, and especially, so far as we are at present concerned, towards the erection of temples and monuments worthy of the just pride of the nation. A sense of freedom and relief from long and troublous fears must have been the ruling feeling of the time; and of the efforts, both intellectual and artistic, which such new-born feelings engendered, history has its examples. Of all the Greeks, the Athenians had in that crisis earned the best title to patriotic emotions, and in Athens, above all Greece besides, the aspirations were highest. Nor were means wanting to second the boldest designs. The Peloponnesians had loitered in the great conflict with the Persians, and in sharing the new impulse they loitered also. The Persian invasion had not, however, been hurled back by a stroke of fortune, but, on the contrary, by the united action which discipline and severe habits of life gave to the Greek forces; and in the same way the men who thereafter achieved the first triumphs in art, who diffused freedom throughout its realm, were men who had been trained in severe schools, where close study, no less than respect for popular feeling, restrained the exercise of the imagination. Accordingly, before we can appreciate the artistic freedom established by Phidias, we must see how far his early training prepared him to fight the battle. This can only be done by examining the works of other sculptors, either pupils of the same master, as were Myron and Polyclethus, or probably contemporary, though more hardened in the traditions of their school, as was Calamis the Athenian, with whom we begin, remarking that the only known approximate date in his lifetime is from 468 to 464 B.C. The works of Calamis extended over a tolerably wide field of subjects, and were executed partly in marble and partly in bronze; but with the exception of two copies of his statue of Hermes Criophorus at Tanagra, on the coins of that town, and in a marble figure in Wilton House, none of our remains of ancient sculpture have as yet been identified with his style. Cicero and Quintilian speak of him as less rigid and hard in his rendering of the human form than Callon and Canachus; but the real advance with which his name is associated was in the rendering of expression in the female face, and in the treatment of draperies. A figure of Alcmena by him was highly praised (Pliny, *N. H.*, xxxiv. 19, 71), while his statue of Sosandra, on the Acropolis of Athens, is spoken of in the highest terms by Lucian for its chaste and tender expression, for its taste in dress, and for the noble bearing of the whole figure. His horses were always incomparable. To have attained the power of expressing modesty and mobile

character in a figure was to have laid the foundation for idealism in its true sense; and Calamis was therefore on the same path with Phidias.

We come now to Myron, a native of Eleutheræ in Attica, and a pupil of Ageladas of Argus. With rare exceptions, he worked in bronze, and that of the Æginetan kind, while Polyclethus employed the bronze of Delus. His works, which were numerous, and scattered from Asia Minor to Sicily, may be divided into the four classes of deities, heroes, athletes, and animals, with a considerable variety ranging within each of the classes. He avoided female figures almost throughout; and though he was the author of statues of Dionysus and Apollo, it should be remembered that these deities had not become soft of form till Praxiteles made them so. He preferred the well-knit figures of athletes, or of Perseus or Hercules. His animals were marvels to the ancients; and the human figures in which he succeeded best were those in which purely physical qualities were pronounced.

We have reached the time of Phidias, and have now done with the imperfections in sculpture, so far at least as they originated in want of knowledge either of the human form or of technical means. Phidias, the son of Charmides, was an Athenian, and must have been born about 500 B.C., or a little before, if we can trust the statement (Plutarch, *Pericl.*, 31) that in the portraits of himself and Pericles, which he placed on the shield of Athene Parthenos, he appeared a bald-headed old man, while Pericles appeared handsome and full of vigor. A fragment of a marble shield in the British Museum, found on the Acropolis of Athens, and representing a combat of Greeks and Amazons, in which a bald-headed old man appears, has been recognised as a rough copy of the shield in question. Phidias began his career as a painter; then turning to sculpture, studied first under his townsman Hegias, and afterwards under the Argive master Ageladas. It may have been due to his training in this school that his first two important works were executed in bronze. The first was a large group, commissioned by the Athenians to be paid for out of their booty from the Persian war, and to be dedicated at Delphi. The second was a colossal statue of Athene, the Promachos, also commissioned by the Athenians out of the Persian booty, and when finished erected on the Acropolis, between Propylea and Erechtheum, the top of the spear which she held, and the crest of her helmet being visible at sea from Cape Sunium. On certain coins on which the Acropolis is figured occurs a statue which seems to correspond with the description, except that the goddess there stands placidly, an attitude that does not suit the idea of a Promachos. This idea is finely embodied in a small bronze statuette, found on the Acropolis and now in the British Museum, representing the goddess striding forward. He had previously made a figure of Athene in gold and ivory for a temple at Pallene in Achæa, and this must be regarded as the first of his works executed in the material in which he afterwards achieved his greatest triumph.

We must suppose that his faculties were now at their best, that he was fully aware of the peculiarities of treatment required by the different materials in which sculptors then worked, and had found the best scope for his own talent in chryselephantine sculpture. The two works with which his fame was chiefly associated were in gold and ivory,—the colossal statues of Athene for the Parthenon at Athens, and of Zeus for the temple at Olympia. After the completion of the former statue, Phidias accepted the invitation of the people of Elis to exert his highest power in fashioning for their temple of Zeus at Olympia a statue worthy of the majesty and grandeur of the supreme god of Greece. His workshop

was near the Aitis or sacred grove, where through successive centuries down to the 2d A.D. it was preserved and pointed out with feelings of reverence. The finished work was over 40 feet high, and represented the god seated on his throne, his right hand holding forward a figure of Victory, and his left resting on a sceptre on which the eagle was perched. On his head was a wreath of olive. The drapery was of gold, richly worked with flowers and figures in enamel, in the execution of which he was assisted by his brother or cousin Panæus.

The throne was mostly of ebony and ivory, inlaid with precious stones, and richly sculptured with reliefs, and in parts painted. Of this, the greatest work of Phidias, nothing but the description now remains. The figure of Zeus seated on a throne, which occurs on coins of Elis struck in Roman times, may have been intended as a reminiscence of it. On the other hand, there is in the British Museum a silver coin of Elis, struck in the best period of Greek art, on which is a head of the god so singularly powerful in type that we are tempted to believe it to be a copy from the head of the statue of Phidias, appealing to the analogy of the coins of Argus with what is accepted as a copy of the head of the figure of Hera by Polycletus. Among the existing examples of Greek sculpture there is only one which claims to be a direct work of Phidias, and that is one of the two colossal marble statues on the Monte Cavallo at Rome, inscribed respectively "opus Phidiæ" and "opus Praxitelis." Grand as both are, the marking of the pupils of the eyes and the treatment of the armor prove them to have been executed in Roman times, probably as copies of celebrated statues.

The mantle of Phidias fell on his pupil Alcámenes (Pausanias, v. 10, 8), an Athenian, or, as others said, a Lemnian, the lofty conception in his figures of deities being highly praised (Quintilian, xii. 10, 8), while in point of gracefulness in womanly forms he appears to have excelled his master. His most celebrated work was a statue of Aphrodite for her temple, of which, however, the merit of the last touch was ascribed to Phidias (Pliny, xxxvi. 5, 16). Her cheeks, hands, and fingers were specially admired; but as to the attitude and general effect we have no information, and are not justified in accepting the Aphrodite of Melus in the Louvre as a copy of it, much less the original work. How far he may have been possessed of the power of creating new ideal types is not expressly recorded, except in the instance of his statue of a triple Hecate, probably such as we know her in later works. On the other hand, there was doubtless scope for extending the new influence of Phidias in such types as those of Æsculapius, Hephestus, and Ares, and it has been conjectured that in his statues of these deities he succeeded in infusing the spirit of his master.

Scarcely less famous was another pupil of Phidias, Agoracritus of Parus, who so far identified himself with the master's style that two marble statues of deities by him were sometimes ascribed to Phidias. The one was a figure of Nemesis in Rhamnus; the other, a statue of Rhea in the Metroon at Athens. From his hand were also the bronze statues of Athene Itonia and of Zeus, in the temple of that goddess between Alalcomenæ and Coronea. Next we have Colotes and Thrasymedes of Parus, both of whom occasionally aspired to retain the chryselephantine technique of the master; and finally, Theocosmus of Megara.

The difference of temperament between the Athenians and Peloponnesians was strongly marked in the schools of sculpture peculiar to each. Political rivalry had its exact counterpart in artistic rivalry, in which Phidias represented Athens, and Polycletus the Peloponnesus. The works of the latter appear to have been always

chastened with an hereditary severity, to have been attractive by the purity of their style and the finish of execution, but not commanding in aspect. It was not, however, in producing statues of deities that Polycletus delighted most; and if surpassed by Phidias in that instance, he was quite without a rival in his own province, the rendering of the form of ideal athletes. Of this class were his Diadumenus, his Doryphorus, and a third figure (unless the Doryphorus was meant by Pliny) known as the Canon. Of the first, several presumed copies in marble exist, two of them in the British Museum but in no case furnishing an adequate illustration of his style. The same may be said of the copies of the Doryphorus.

None of the pupils of Polycletus arrived at distinction.

Examples of what may be called a lower branch of sculpture (gem-engraving) are exceedingly rare in this period. So far as Athens is concerned, this will appear less remarkable if we suppose that gem-engraving and die-sinking were one profession, and remember that at least the latter must have been, with few exceptions, unpractised there in the best period, the coins being allowed, probably for commercial reasons, to retain the old stamp with which people were familiar. Possibly also the high ideal of the times was above the grasp of such artists, though it was seized pretty generally by the sculptors of stelæ, who could hardly have been men of note.

In the records of painting during the previous period it was noticeable that painters even then, in what appeared to be one of the earliest stages of the art, were accustomed to execute large compositions, such as battle scenes. The essentially decorative character of the art required that it should be so, just as in early sculpture, in which also the decorative element prevailed, our principal records are those of large compositions, such as the chest of Cypselus or the shield of Achilles. While the epos flourished, and the country was full of heroic legends, there can be little doubt but that the principal pleasure derived from works of art lay in the variety of the subject and the manner in which it was presented, that is, in the composition, and not in the truthful rendering of individual forms. To heighten the interest of the spectator, it was usual to write the name beside each of the persons that appeared in a picture, as we see it done on the early vases. The same was the case with the sculptured reliefs on the chest of Cypselus, which on this account presents a remarkable contrast to the shield of Achilles, on which, as in Assyrian sculptures, there is no prominence of individuals, and therefore no accurate study of the human form. It is not to be supposed that in the early stage of Greek painting individual forms were studied with any other view than that of rendering the characters more intelligible; but with this a beginning was made to lift the art into a higher sphere. At this stage appeared Polygnotus, a native of Thasus, and a son of the painter Aglaophon, of whose probable connection with the early Samian school mention has already been made. Attracted to Athens by the opportunity presented by the new buildings which were then being erected, Polygnotus, either owing to some family tie or through the recommendation of his own ability, found favor with Cimon, to whose zeal and taste the new impulse for the improvement of the city was due. In company with, or perhaps rather with the assistance of, the Athenian painters Micon and Panæus (the brother or cousin of Phidias), he was employed to execute wall paintings for the Stoa Pœcile, the Theseum, and the Anaceum, or temple of the Dioscuri, at the northern foot of the Acropolis. For his services, and especially for the disinterestedness of his character, Poly-

gnotus received what was then regarded as the highest distinction—the freedom of the city of Athens. His friendship with Cimon was intimate, and led, it was said, to an affectionate acquaintance with Cimon's half-sister, the beautiful Elpinice. From Athens he was called to Delphi to execute a series of paintings for the two long walls of the Lesche, a building erected there by the people of Cnidus. The paintings, however, appear to have been commissioned by the Amphictyonic council, if it is right to be guided to that conclusion by the statement that the painter was rewarded with the rights of hospitality throughout the states included in the Amphictyonic league.

The history of architecture during this period is an unexampled record of great undertakings throughout Greece, but more especially in Athens, which, if it had suffered most from the Persian invasion, had also in the end acquired the most ample means of repairing its ruins and adding fresh lustre to its aspect. Themistocles having been banished, the administration and the carrying out of works begun by him—such, for example, as the long walls connecting the city with the harbor—fell to Cimon. The city walls on the south side of the Acropolis were rebuilt, and a tower erected to command the entrance, which, however, being afterwards rendered useless by the erection of the Propylæa, was removed to make way for the temple of Athene Nike. Among the new temples the first to be mentioned is the Theseum, which is not only well preserved still, but is also the oldest existing example of the Attic-Doric order. The other temples, the erection of which may with great probability be traced to Cimon, are the Anaceum, or temple of the Dioscuri, at the foot of the Acropolis, on the north side; and a small temple, now quite destroyed, on the left bank of the Ilissus, which existed in Stuart's time, and, from his drawing is seen to have been of the Ionic order, differing from the Attic-Ionic in wanting the dentils of the cornice, in having the base of its columns composed of a trochilus between two spirals, and in having its architrave quite plain. Cimon was succeeded by Pericles, under whose administration the resources of the city, not only in means, but in the talent of using the existing means, were applied with the greatest judgment and energy, foremost among his advisers being Phidias. According to Plutarch Phidias exercised a general supervision over all the public works then going on. Apparently at this time was erected the Odeum, a building intended for musical performances, circular in form, and, as appears from the records of it, brilliantly decorated with numerous columns in the interior, and with a tent-shaped roof of wood. It was the Acropolis, however, that was reserved for the crowning effort of architecture in this period. Within the space of probably not more than five or six years there rose on the site of an old temple of Athene, which had been destroyed by the Persians, the Parthenon, a model for all time of the Doric order, pure and perfect in its architectural forms and proportions. The architect was Ictinus, who was assisted by Callicratidas. The next undertaking was the so-called Propylæa, a building which, though practically serving as an entrance to the Acropolis, aspired to a highly decorative character. The architect was Mnesicles. Contemporary with the building of the Propylæa, it appears, was that of the small temple of Athene Nike, on the Acropolis, which, on the removal of a Turkish structure in 1835, was recovered in almost all its parts.

Fourth Period.

Since the beginning of our last period, the political and social circumstances of Greece have suffered a marked change. More or less it was then accepted as

a dogma that, provided the state was flourishing, the prosperity of individuals mattered little. All were for the state, and by their union in the state's emergency had achieved a glorious freedom, the sense of which filled the national mind, and prepared it to respond with a fostering sympathy to the efforts of artists, whom it also inspired. Yet, conscious as they must have been of their own services, the men of that generation turned rather in pride to the deeds of their ancestral heroes, and in humility to the assistance of the gods. They sought to frame their conduct on the traditions of the past. They were rigorous and strong in thought. Passion was a thing to deplore, not to study, analyse, and represent. The national history was still unchequered. Nor was the house of Hellas as yet to any degree openly divided against itself. There was no need of artists—whether poet, as Æschylus, or sculptor, as Phidias—to depict the struggles of passion or other conditions of the mind. Now this is all changed. The nation has lost its unity, and the Peloponnesian war has made havoc of its resources. Æschylus has given way to Sophocles and Euripides, Phidias to Scopas and Praxiteles. Poets and sculptors of the new generation have chosen as their theme the representation of pathos and of the conditions of the mind generally. That such was the character of what is called the second Attic school of sculpture is known principally from the records of artists. Of works directly from the hand of any of the masters of this school there is no example in existence, so far as we know at present. On the other hand, there are many copies of their works, from which, with the aid of records, some idea may be formed of their style.

The first of the artists of this school was Scopas, a native of Parus, and, as it would seem, the son and pupil of Aristandrus, a worker in bronze, in which material the son appears to have commenced his career as a sculptor.

That Praxiteles was directly a pupil of Scopas is not proved even by the fact that he worked in the same artistic vein and spirit, with a result which rendered his style undistinguishable from that of the older master to the eye of Roman connoisseurs. Still, it will be safe to assume that he was largely influenced in his youth by the then favorite sculptures of Scopas. The scene of his labors was mostly Athens and the neighboring towns. That he accompanied Scopas to Halicarnassus to assist with the sculptures of the Mausoleum, as is stated, is probably true; but from the fact that elsewhere in place of his name occurs that of Timotheus, it has been inferred that he may there have abandoned his original intention, and confined himself to the execution of those statues for towns in that district of which we have records. About 340 B.C. he returned to Athens, and there remained till his death, studying, with Phryne as his model, the expression of sensual beauty in its highest type. Of his works, the number of which was unusually large, the most celebrated were—(1.) The marble statue of Aphrodite at Cnidus, of which the more or less modified copies, as the Venus of the Capitoline Museum and the Venus de Medicis, together with the ancient records, show that the goddess was represented standing nude at the moment when she has left her bath, and being sensitive to the air, presses her left leg against her right, and looks towards the drapery which she has already laid hold of with her left hand. (2.) A statue of Aphrodite at Thespiae; beside which was placed (3.) a portrait statue of Phryne; and (4.) a statue of Eros, in Parian marble, of which there are two accounts,—either that it was given by him to Phryne in token of his admiration, or that she contrived to obtain it by a ruse, and then dedicated it at Thespiae. Apparently exhibiting the same refinement of

youthful form was his statue known as the "Celebrated Satyr," in Athens. Of his Appollo Sauroctonus several copies of inferior merit exist. His statue of Artemis Brauronia at Athens had a mouth inviting to a kiss.

Besides sculptors, otherwise famous, who applied themselves to toreutic art, there were others who made this their principal occupation. Of these we know Mys, who executed the designs on the shield of the bronze Pallas of Phidias on the Acropolis of Athens; and, more celebrated, Mentor, who worked chiefly on silver bowls and cups, for which fabulous sums were afterwards paid by Roman collectors. He must have lived before the time of Alexander the Great, since some of his works perished in the burning of the temple of Diana at Ephesus. Two other *cælatores* apparently of this period were Acragas and Boëthrus.

A branch of art-allied to the *cælatura* is that of die-sinking and gem-engraving. Of the former the finest examples during this period are the silver coins of Syracuse, especially the decadrachms with the head of Ærethusa on the obverse and a quadriga on the reverse. The presence of the engraver's name on many of these coins is testimony of the value attached to their work. From this source we know the engravers Cimon and Euzænetus. Other names, such as Euclides, Eumenus, Eumelus, Phrygillus, and Sosion, also occur on smaller silver coins. With the exception of Athens, where the archaic type was preserved, there is a general feeling for beauty throughout the Greek coinage of this period, the specimens most deserving of study being those of Arcadia, of the Opuntian Locri, of the Macedonian kings Philip and Alexander, of the Chalcideans of Thrace, of Cydonia in Crete, where the name of the engraver Neutantus occurs, and of Lesbos. In gem-engraving during this period the fame of Pyrgoteles is known, but of all the existing gems which bear his name it may be questioned whether one reflects adequately his style. It may be taken as certain that some of them are from his hand. He was the court engraver of Alexander the Great, whose portrait he made on an emerald.

In the person of Apelles, the son of Pytheas, a native of Colophon, were combined, if we may judge from his reputation, all the best qualities of the hitherto existing schools of painting. It should, however, be remembered that what we know of him comes entirely from Roman and late Greek sources, and represents rather the taste of these times than a critical judgment on his works. He was a pupil of the otherwise unknown painter Ephorus of Ephesus, which town, already celebrated as a centre of painting, he adopted as his home. But so high was then the reputation of the Sicyonian school, headed by Pamphilus and Melanthis, that on completing his studies at Ephesus he repaired to Sicyon, either to see for himself or to profit by the fame of these masters. From Sicyon he proceeded, perhaps through the influence of Melanthis, to the court of Macedonia, where he was employed, first by Philip, and afterwards, under circumstances of the greatest intimacy, by Alexander, whom he accompanied as far as Ephesus on his expedition into Asia. Of the figures of deities painted by him the most renowned was that of Aphrodite Anadyomene, originally in the temple of Æsculapius in Cos, represented rising out of the sea, and wringing the wet out of her hair, with swelling bosom and an expression of desire in her eyes. A second figure of the goddess, also intended for Cos, remained unfinished at his death. Of personifications and allegorical figures or groups, such as delighted the age in which he lived, we have examples — of the former in his group of Bronte, Astrape, and Ceraunobolia; and of the latter in his famous picture of Calumny. Partly of this character also were his two pictures of

Alexander grouped with Castor, Pollux, and Victory; and Alexander in a triumphal car, beside a personification of war, in the form of a captive with hands bound behind back and seated on armor. The execution of subjects of this nature, for which thought and reflection are mainly required as opposed to the poetic and spontaneously creative faculty of a true artist, has been urged as detracting from the greatness of Apelles, and to this extent, no doubt, he was subject to the weakness of his times. Like Correggio, with whom he has been compared, he lived at a time when the great creative spirit had passed away, and it remained for him, as for the Italian master, to discover the last resources of his art for the attainment of powerful effect and absolute finish simultaneously. To refine the harmony of his light and tones, as well as to protect his paintings from dirt, he employed a peculiar black glaze which broke the sharp contrasts of colors required for such powerful effects as the appearance of Zeus hurling lightning. With regard to his colors little is known. The statement that he used only four may or may not be correct. Of his mere skill we have an example in the figure of Hercules, afterwards in Rome, of which it was said that the face, though turned away from the spectator, was suggested almost as vividly as if it had been actually painted. In technical skill Apelles confessed himself equalled by his contemporary Protogenes the Rhodian, claiming, however, as his own special superiority, that he knew when to stop. The fault of Protogenes was over-elaboration. On one painting he is said to have worked seven or eleven years, finishing it with four separate glazes to protect it from injury. Of the painters of this period there are still to be mentioned Antiphilus, a native of Egypt, and a pupil of Ctesidemus; Theon of Samus, who was praised for his happy choice of the right moment at which to seize an action; and Aetion.

With the close of the Periclean period in Athens the public desire for more temples seems to have ceased; so that the architecture of the period now before us is to be traced rather in works of utility, whether public or private. Of the former class are — (1), the stadium at Agræ for the athletic competitions at the Panathenaic festival; (2), the gymnasium; (3), the store-house at the Piræus, built to contain the equipments of 1000 ships. From private sources were (4), the temple of the Muses, said to have been erected by Plato, in the Academy; and (5), the choragic monument of Lysicrates, which is the only existing example of Athenian architecture of this time.

Fifth Period.

The conquests of Alexander had opened to the Greek gaze the East, gorgeous in its personal attire and equipments, and unlimited in its resources for the encouragement of personal vanity. Alexander appeared in Asiatic costume, and what became the monarch was shortly found becoming to the subject. Under his successors, in what is called the Macedonian, or, better, the Hellenistic period, the opulence and taste for luxury of the times led artists to aim at producing works conspicuous for picturesqueness; not, however, that picturesqueness which is born of a fine fancy, but that which originates in a studied effort to throw a gleam of romance over a plain historical incident. The creation of ideal types of deities ceased, and the production of allegorical figures, which had found acceptance in the preceding age, took its place. These figures were simply studies of character, and implied a faculty of observation which the existing portraits of this period on coins and in marble warrant us in estimating highly. To this, no doubt, was added a power of generalisation which enabled the artist to deduce a type from a num-

ber of individuals, as, for example, in the type of Gauls introduced by the school of Pergamus. In figures of deities or heroes the old types were retained. It was in portraiture that the essential characteristic of the time consisted. With art in this condition Græcia Capta enthralled her Roman captors, and the further development of this phase of art was transferred to Rome. For this reason we shall here follow the unusual plan of classing the Hellenistic and Roman art under one period.

The two principal schools of sculpture of the last period are represented in this by the sons of the two great masters of each,—the Athenian school by the sons of Praxiteles, Cephisodotus and Timarchus, who worked together. The former appears to have been the more gifted of the two, if we may judge from the pains bestowed on certain statues of deities by him alone. Of their contemporaries little is known beyond that their chief occupation was in portrait sculpture. The traditions of the Sicyonian school were left in the hands of the sons and pupils of Lysippus, of whom the ablest was Euthykrates, who preserved the severity of the older schools in opposition to the tastes of his times. The effect of this upon his pupil Tisicrates led to so close a reproduction of the manner of Lysippus, that in many cases it was difficult to distinguish his work from that of the old master. In the same spirit, and with greater success, worked Eutychnides of Sicyon, and Chares of Lindus in Rhodes. From the hands of Eutychnides we know of a bronze statue of the river Eurotas, in which the mobility of water was finely suggested in the human form, and a highly-praised statue of Tyche for the town of Antioch, of which several copies exist, including a small one in silver in the British Museum. Chares is known mainly as the author of the bronze Colossus of Helios at Rhodes, a statue 105 feet high, which after standing a marvel to all for fifty-six or sixty-six years, was broken across the knees and thrown to the ground by an earthquake. The rising importance of Rhodes encouraged the foundation of a school of sculpture which adopted the manner of Chares, and aimed at effect by colossal proportions and picturesque situations. To this school belonged Apollonius and Tauriscus, the authors of a colossal marble group which has been identified with that in the museum of Naples, known as the "Farnese Bull," and representing Amphion and Zethus in the act of binding Dirce to the horns of a bull in presence of their mother Antiope, and, whether copy or original, an admirable illustration of the Rhodian school. The moment seized by the artists is one of profound pathos; but, justly deserved as the punishment of Dirce may have been, it is impossible to look upon it without pain. The same feeling, it may be imagined, was awakened in the spectator by the bronze group of Athamas seized with insanity after slaying his son Learchus, by Aristonidas, another artist of the Rhodian school. From the instances of subjects in which cruelty and deep emotion were combined, it has been argued that the group of Laocoön, which was the work of three Rhodian artists—Agesander, Athenodorus, and Polydorus—may properly be assigned to the Rhodian school of this period. On the other hand, it is argued by critics of seemingly equal competence, that the subject of the Laocoön is too harrowing for the Greek taste even then, and must have been executed under the influence of the favorite cruelties practised in the Roman circus. The decision between these two opinions is left entirely to taste, owing to the ambiguity of the words of Pliny. From Rhodes we pass to Pergamus, where, under the courtly influence of Attalus I. (241-197 B.C.) and Eumenes II. (197-159 B.C.), was formed a school of

sculpture which derived a vigorous impulse as of a new life from the strange class of subjects it was called upon to undertake. It was called upon to glorify the decisive victory of Attalus over the Gauls (239 B. C.) by groups and large compositions of battle scenes, in which the first difficulty was to produce the type of these barbarians, and to carry it out consistently in the various attitudes and incidents of a battle; as, for example, in their dogged submission under captivity, or their grim expression under pain; or, again, the abject misery of their wives when a battle had been lost. Nor was Attalus content to adorn his own capital with artistic productions. To Athens he made a present of four groups representing battles between gods and giants, between Athenians and Amazons, between the Greeks and Persians at Marathon, and between his own army and the Gauls in Mysia, showing in each case the defeat of a barbarous race. The height of the figures was $3\frac{1}{2}$ feet, and that there must have been a considerable number of them is clear from this, that the occurrence of Bacchus in the group of the Gigantomachia presupposes the existence of the other superior deities. Of the entire series nine figures have been identified in various museums, while to the same school belong the dying Gaul in the Capitoline Museum, known as the "Dying Gladiator," and the group of a Gaul and his wife in the Villa Ludovisi.

After the loss of national independence little remained for the Greeks to do but to profit by the liberal patronage of their Roman masters, whose cupidity in matters of art was by no means satisfied with carrying off as many as possible of the existing sculptures. The increased demand led to a new energy, of which Athens was at first naturally the centre, whence the term "New Attic" is applied to the sculpture of this period. As, however, this new energy was chiefly directed to the reproduction of the favorite types of the old masters, the result was not, as under other circumstances it might have been, the formation of a new school properly so called. At this time the principal sculptors were Polycles of Athens, his son Timarchides, his grandson Dionysius, and another Dionysius, all of whom, after earning a reputation by their work in various parts of Greece, appear to have followed Metellus to Rome, which now became the artistic centre of the world. Towards the end of the republic there lived in Rome a sculptor, Pasiteles, who, if not superior to the artists of the new Attic period in point of creative power, was certainly more gifted than they with skill and carefulness in the execution of his work, which ranged over statuary, sculpture, and cœlatura, including chryselephantine figures, for which a taste had revived. As, however, none of his works exist now, we can only judge of his manner by that of his pupil Stephanus, from whose hands we have the statue of Orestes in the Villa Albani. It is called Orestes from its resemblance to the male figure in the group of Orestes and Electra in Naples, with which, as an imitation of the archaic style, it may be compared. In both, however, it has been observed that the archaism is limited to the proportions, attitude, and general aspect, but that the details of anatomy have been worked in from the living model.

When public encouragement of art takes the form of a desire for reproduction from ancient masterpieces, it is natural that such minor arts as those of cœlatura and gem-engraving should flourish. The production of silver vases adorned with subjects in relief had become a profitable occupation in the wealthy times of Hellenism. It was not, however, till the latter half of this period that truly fabulous sums came to be paid for work of this kind, in which Pasiteles and Arcesilaus achieved great success. Besides them we hear of Posidonius of Ephesus, Zopyrus, Pytheas, and Teucrus. Among the

many existing examples of silver work of this period, one—a vase found in 1761 at the Porto d'Anzo, and belonging to the Corsini family—has been identified as a copy of the silver vase by Zopyrus representing the acquittal of Orestes before the Areopagus. The immense number of existing statuettes, vases, utensils of various kinds in bronze and silver, dating from this period, are evidence of its artistic activity, and at the same time of the closeness with which Greek models were adhered to.

Under the influence of the luxurious tastes in the times of the Ptolemies, gem-engravers aimed mostly at effect, and to this end sought out specimens of onyx and sardonyx which from their own splendor would lend a charm to the work. A gem was now a thing to be worn flauntingly. Hence the chief examples of the art are the cameos, of which from the latter half of this period we have still some magnificent examples. Of these, the most important, artistically, is the large cameo, now in Vienna, representing, in a partly allegorical and partly literal fashion, the suppression of the Pannonian revolt by Tiberius and Germanicus.

In the history of painting during this period few names of importance occur.

Closely allied to painting is the art of mosaic-working, which, though occasionally employed for the pavements of the earlier temples, as in the pronaos of the temple at Olympia (*Expédition de la Morée*, i. pl. 63), did not till after the time of Alexander assume an importance which entitled it to be ranked as an independent art. The first mosaic artist of consequence whom we hear of is Sosus of Pergamus, celebrated as having introduced the practice of decorating floors of houses with imitations of characteristic objects, such, for example, as the accompaniments of a feast in a dining-room.

What was said of the progress of architecture at the close of last period should be here borne in mind, as it continues to apply to the first half of the period now before us. While the building of Alexandria supplied a model and an impulse, which the successors of Alexander availed themselves of, in the construction of new towns, the example of boundless luxury, in the decoration of even temporary monuments, which was set by Alexander in the erection of a funeral pyre for Hephæstion in Babylon, was also eagerly followed by his successors. From the work of Callixenus on Alexandria we have (Athenæus, v. p. 196) a description of the tent erected by Ptolemy Philadelphus for a Dionysiac festival, and of the splendid colossal barge of Ptolemy Philopator on the Nile (*ibid.* p. 204, a). Still more magnificent and stupendous in its dimensions was the ship of Hiero of Syracuse, with its granaries, dwelling-houses, towers, gymnasium, and park, for the construction of which Archimedes and the Corinthian Archias were employed. Greece proper, however, shared little in this prodigality. Thebes was, indeed, restored after its destruction by Alexander; and Athens, still the eye of Greece, obtained many marks of favor from the princes of the time, who sought to identify their names with her glory by erecting public monuments of various kinds.

The presence of countless specimens of Greek art in Rome, carried off by plunderers like L. Mummius, produced a general craving for Greek architecture also. The first step in this direction was taken by Q. Cæcilius Metellus, who brought a Greek architect, Hermodorus of Salamis, to Rome to build a temple to Jupiter Stator in the pure Greek style. The public favor with which this was viewed may be gathered from the fact, that shortly after we find D. Junius Brutus employing Hermodorus to build a temple to Mars. Of the Roman

architects who during the republic adopted the Greek style, the most distinguished were Cosutius and C. Mutius. The Greek had either supplemented or become blended with the native Roman architecture when the extraordinary activity in building, of which Pompey and Cæsar were the leaders, set in, not only in Rome, but throughout the provinces of the empire. The building of temples and monuments, which under Augustus had been the chief occupation of architects, gave way under his immediate successors to constructions of a more useful and sometimes of a colossal type, such as bridges, canals, aqueducts, and harbors. The enlargement of the imperial palaces on the Palatine, particularly the construction of the golden house of Nero, gave scope to the boldness of design and extravagance of execution possessed by the architects Celer and Severus. In the following times those of Vespasian, Titus, and Domitian were characterised by a series of buildings which had not their equal in the architectural history of Rome, as, for example, the Coliseum, a building erected to contain 87,000 spectators, and still in its ruins the most striking monument of imperial Rome. While the chief interest of Trajan was in the construction of roads, bridges, and harbors, his successor, Hadrian, was not only himself ambitious as an architect, but gave a new impetus to the erection of splendid buildings throughout the empire. From this time onward Roman architecture began to sink rapidly, its original tendency to florid decoration obtaining more and more free rein, till finally discrimination was abandoned. The ruins of Palmyra and Baalbec (R. Wood, London, 1827), the arch of Severus, the baths of Caracalla and Diocletian, and the arch of Constantine, are evidence of this.

For Etruscan Archæology, see ETRURIA.

ARCHANGEL, government of European Russia, is bounded on the N. by the White Sea and Arctic Ocean, on the W. by Finland and Olonetz, on the S. by Vologda, and on the E. by the Ural Mountains. It comprehends the islands of Nova-Zembla, Waigatz, and some others. Its area is estimated at 331,640 square miles, and its population (estimated) about 350,000. The climate is for the greater part of the year intensely cold. That part of Archangel which lies within the arctic circle has a very desolate and sterile aspect, presenting little to the eye but extensive plains of sand and moss. The winter is long and severe, and even in summer the soil is frozen at a little depth below the surface. The rivers are closed in September, and scarcely thawed before July. South of the arctic circle the greater part of the country is covered with immense forests, with extensive lakes and morasses, while other parts afford excellent pasturage. The spring is moist, with cold, frosty nights; the summer, a succession of long foggy days; the autumn moist; and the rivers are closed from October to April. The northern districts are incapable of being cultivated, and the inhabitants support themselves by fishing and the chase. In the southern districts considerable quantities of hemp and flax are raised, but grain crops are little attended to, and the bark of trees is ground with corn to eke out the scanty products of the harvest. Potatoes are grown as far north as 65°. The principal wealth of the government consists in its immense forests, furnishing materials for ship building, which is carried on to a considerable extent. The horses and cattle are diminutive, except in the district of Kholmogory, where excellent cattle are reared. The calves are sent to the St. Petersburg market, where the veal is especially prized. Gold is found in the circle of Cola, naphtha and salt in those of Kem and Pinega, and coal, or rather lignite, in several places in Mezen. The preparation of pitch and tar is an active branch of industry; and in the districts

around Archangel coarse linens are manufactured to a considerable extent, as well as cordage, mats, leather, tallow, turpentine, and potash. This government is divided into eight circles, viz.—Archangel, Shenkursk, Mezen, Cola, Onega, Pinega, Kholmogory, and Kem. Its chief rivers are the Onega, Pinega, Dwina, Mezen, Petshora, and Ousa. Sulphurous springs are found in the circles of Kholmogory and Shenkursk. The population was originally Finnish, but it is now chiefly Russian, with some Samoides and Laplanders.

ARCHANGEL, the chief town of the Russian government of the same name, is situated at the head of the delta of the Dwina, on the right bank of the river. By river and canal Archangel is in connection with a large part of European Russia, and a telegraph line unites it with St. Petersburg. The harbor is at the island of Solombaly, about a mile below the town, and is open only from June to October. A bar at the mouth of the Dwina, with only 13 or 14 feet of water, obliges vessels of greater draught to load and unload outside by means of lighters. About 12 miles below the town there is a Government dockyard, with slips for building vessels, and also some warehouses belonging to merchants in the city. The best season of the year in Archangel is from the middle of June to the middle of August. After that period the nights become cold; and in September it is often stormy. The shortest day has only 3 hours 12 minutes, the longest 21 hours 48 minutes. Population in 1887, 21,000.

ARCHBISHOP, the title of a church dignitary of the first class. Archbishops were not known in the church before the 4th century after Christ, when the term "Archbishop" was introduced in the East as a title of dignity, which did not necessarily imply any superiority in jurisdiction over a bishop. Athanasius, bishop of Alexandria, appears to have been the first who made use of the term in applying it as a mark of personal honor to Alexander, his predecessor in the see of Alexandria, and Gregory Nazianzen applied the term in like manner to Athanasius. In the following century the title of archbishop seems to have been applied to the bishops of the more important sees, as the names of several archbishops are recorded in the list of church dignitaries, who were assembled in the council of Chalcedon in 451 A.D. In the Latin Church the title was hardly known before the 7th century after Christ. Isidore of Seville (Hispalensis) is the first writer who speaks of archbishops, distinguishing them as a class from patriarchs, metropolitans, and bishops. Archbishops in the present day are for the most part either patriarchs or metropolitans; but an archbishop is not necessarily a patriarch or a metropolitan, and there are metropolitans who have only the title of bishops. The ecclesiastical government of the Church of England is divided between two archbishops,—the archbishop of Canterbury, who is primate of all England and metropolitan of the province of Canterbury, and the archbishop of York, who is primate of England, and metropolitan of the province of York.

ARCHDEACON. The office of archdeacon is of ancient institution in the Christian church, as archdeacons are mentioned in the 4th century after Christ. The title was originally given to the chief deacon in each diocese, who had the charge of the temporal affairs of the church, and the supervision of all matters which appertained to the order and decency of divine service. In the course of time the archdeacons encroached upon the episcopal jurisdiction, but their encroachments were restrained in England by the Council of London, 1237 A.D., and in other countries by ecclesiastical councils held in the 13th and 14th centuries.

ARCHDUKE, a title borne during the Middle Ages

by the dukes of Austria, Lorraine, and Brabant. All three archduchies having devolved to the imperial family of Austria, the sons of that house are styled archdukes, and the daughters archduchesses.

ARCHELAUS, a Greek philosopher, was a native most probably of Athens, though some say he was born at Miletus. Nothing is known of his life, but as he was a pupil of Anaxagoras, he must have lived about 450 B.C. By several writers he is said to have been the teacher of Socrates, but this report has no support from Plato, Aristotle, or Xenophon, and probably has no foundation save the wish to connect Socrates closely with preceding philosophy. So far as the opinions of Archelaus are known, he seems to have followed with some deviations his master, Anaxagoras. With him he admitted a primitive matter, consisting of infinite particles similar in nature to the bodies formed from them. He further admitted a ruling mind; but he attempted to overcome the dualism of Anaxagoras, and in so doing, more nearly approached the older Ionic physical philosophers.

ARCHELAUS, natural son of Perdiccas, king of Macedonia, seized the throne in 413 B. C., after having murdered his uncle, his cousin, and his half-brother the legitimate heir. His reign was remarkable for the many improvements he introduced. He fortified cities, constructed roads, and thoroughly organized the army. He endeavored to spread among his people the refinements of Greek civilization, and invited to his court many celebrated men of the time—as Zeuxis, Timotheus, Euripides, and Agathon. In 399 B. C., he was killed by one of his courtiers, Craterus; according to some, designedly, according to others, accidentally while engaged in hunting.

ARCHELAUS, a general of Mithridates, commanded his army in the war against the Romans. He was sent into Greece with an army of 120,000, and after three days' fighting with Brutius Sura, occupied the Piræus. Here he was attacked by Sulla, and after a hard struggle was compelled to withdraw into Bœotia. Sulla followed, and at Chæronea, 86 B.C., completely routed him. A fresh army was sent by Mithridates, but at Orchomenos, after a two days' battle, Archelaus was again defeated. Peace was soon afterwards concluded, but as Archelaus found that he had incurred the displeasure of Mithridates, he fled over to the Romans, by whom he was well received. He is not heard of again in history, but several of his descendants of the same name held high posts under Pompey, Antony, and Augustus.

ARCHELAUS, son of Herod the Great, had the kingdom of Judæa left him by the last will of his father, though a previous will had bequeathed it to his brother Antipas. He was proclaimed king by the army, but declined to assume the title until he had submitted his claims to Augustus at Rome. Before setting out, he quelled, with the utmost cruelty, a sedition of the Pharisees, slaying nearly 3,000 of them. At Rome he was opposed by Antipas and by many of the Jews, who feared his cruelty, but Augustus allotted to him the greater part of the kingdom, with the title of Ethnarch. He married Glaphyra, the widow of his brother Alexander. This unusual and repugnant act and his continual cruelty roused the Jews, who complained to Augustus. Archelaus was deposed (7 A.D.), and banished to Vienne. The date of his death is unknown.

ARCHELAUS, son of Apollonius, a sculptor of Priene, is celebrated by his bas-relief, representing the apotheosis of Homer.

ARCHENA, a town of Spain in the province of Murcia, of interest on account of its hot mineral springs and old Roman baths. Population, 3,000.

ARCHERY, the art or exercise of shooting with a bow and arrow. The origin of the bow as an instrument of war is lost in obscurity. With all the ancient peoples, both civilised and barbaric, the bow was a favorite weapon; and skill in the use of it was regarded by the Scythians as a princely accomplishment.

There is no record of the use of the bow in France until the reign of Charlemagne, in the beginning of the 8th century, although we have evidence that in England both the Anglo-Saxons and the Danes employed it in the chase, as well as in battle against the primitive inhabitants of England, many years before the Conquest. The probability is, that it was first introduced as a military weapon into Britain by the Romans; but it was under the Norman rule that the practice of archery in this island was not only greatly improved, but generally diffused throughout the country, so that England soon became famous for its archery, and her archers took precedence of those of every other nation. To preserve this superiority by constant practice appears to have been the study of many of our monarchs; and numerous statutes for enforcing and regulating the use of the bow among the people were enacted from early times until after the invention of fire-arms. Many laws were also made for securing the presence in distant and obscure parts of the country of persons skilled in the manufacture of bows and all the apparatus appertaining to archery, for guarding against fraud by those artificers, and also for the procuring of a constant supply of bow-staves from abroad. These laws appear to have been absolutely necessary, for in the olden times the English chiefly depended for their success in battle upon the bravery and expertness of their archers, whose appearance generally led to success. William the Conqueror is reputed to have been so admirable an archer that few could bend the bow he used, and his victory at Hastings was certainly due to the skill and intrepidity of his archers. Richard I. performed great exploits with his archers in the Holy Land, where, according to Gibbon, 300 archers and 17 knights, headed by the king, sustained the charge of the whole Turkish and Saracen army. It was in his reign that the renowned Robin Hood flourished in Sherwood Forest. Edward II. levied a company of "Northumbrian archers," in the year 1314, for the invasion of Scotland.

The battles of Cressy and Poitiers were gained by English archers in the years 1346 and 1356 respectively. Edward III. was extremely jealous of the honor of the bow, and anxious that its glory should be maintained. In the early part of his reign it was ordered that most of the sheriffs of England should each provide 500 white bows and 500 bundles of arrows for the then pending war with France. In the following year this order was reissued, with the difference that the sheriff of Gloucester should furnish 500 painted bows in addition. This king embodied a company of soldiers whom he called the "Archers of the Guard." Edward III. also, in 1363, commanded the general practice of archery on Sundays and holidays by the people in lieu of the ordinary rural pastimes, which were forbidden on pain of imprisonment. In this reign the price of bows was regulated by Government; a white bow was 1s., a painted bow 1s. 6d., a sheaf (24) of sharp arrows 1s. 2d., and a sheaf of blunt arrows 1s. Richard II., in 1392, directed that none of his servants should ever be unfurnished with bows and arrows, and that they should avail themselves of every opportunity of practising archery. At the same date an Act of Parliament compelled all persons employed as servants to shoot with bows and arrows on Sundays and other holidays. In the year 1402 the English archers won the battle of Homildon; and in 1403, at the battle of Shrewsbury,

where Hotspur was slain, the most terrible havoc was created by the archers on both sides.

For the manufacture of bows yew was generally preferred to all other woods, but to prevent a too rapid consumption of yew, bowyers were ordered to make four wych-hazel, ash, or elm bows, to one of yew; and no person under 17 years of age, except those possessed of portable property worth 40 marks, or the sons of parents owning an estate of £10 per annum, was allowed to shoot with a yew bow, under a penalty of 6s. 8d. for each offence. That distant counties might be properly supplied with bows and arrows, the king claimed and exercised the prerogative of sending, if necessary, all arrow-head, bow-string, and bow makers, not being freemen of the city of London, to any part of the realm that required the services of such artificers; and neglect of an order to visit a place after the receipt of instructions to repair thereto, was punishable by a fine of 40s. for every day the workman remained away.

In the reign of Henry IV. it was enacted that all arrow-heads should be well braced and hardened at the points with steel, and stamped with the name of the maker, under penalty of fine and imprisonment, and forfeiture of the arrows, &c., in default; and by another statute passed in the same reign, it was enacted that persons from places whence bow-staves were derived, should import four bow-staves for every ton of merchandise taken on board, under penalty of 6s. 8d. for every bow-stave deficient. In this reign the highest price permitted for a yew bow was 3s. 4d. In the reign of Edward IV. it was enacted that every Englishman, and every Irishman living with an Englishman, should have an English bow of his own height; and also that in every township shooting butts should be set up, at which the inhabitants were commanded to practise on holidays, under the penalty of one halfpenny for each neglect. In the same reign the king, in preparing for a war with France, directed all sheriffs to procure a supply of bows and arrows for the service of the state. In 1405, it was made penal to use bad materials in the manufacture of bows and arrows. In 1417 the archers of the army of Henry V. won the battle of Agincourt. This king directed the sheriffs of counties to take six wing-feathers from every goose for the feathering of arrows. In 1478 archery was encouraged in Ireland by statute. In the year 1424 James I. of Scotland, who was himself an excellent bowman, revived the practice of archery among his subjects. Richard III. lent 1000 archers to the duke of Bretagne. The same troops afterwards fought at the battle of Bosworth. In 1485 Henry VII. instituted the yeomen of the guard, who were then all archers, and in the 19th year of his reign the use of the cross-bow was forbidden by Act of Parliament, because the long bow had been of so much greater benefit to the nation. In this reign archery occupied an important position in the fashionable pastimes of the kingdom, and upon the occasion of the marriage of Henry with the Princess Elizabeth it formed a great feature among the nuptial festivities, the king himself joining in the shooting with heartiness and glee.

Several Acts were passed in the reign of Henry VIII. for the encouragement and promotion of archery; one ordered that butts should be erected and kept in repair in all townships, and that the inhabitants should practice shooting at them on holidays. The same Act directed that every able-bodied man not being an ecclesiastic or a judge, should practice shooting with a long bow; and the guardians and employers of youth were ordered to bring up the boys in their charge to the practice of archery, neglect being punishable by fine. In this reign the practice of archery was strongly advo-

cated from the pulpit by Bishop Latimer; and so jealous were the English of rival nations competing with them, that aliens were forbidden to use the long bow.

Archery continued to be an object of attention and solicitude with the Legislature during the reign of Elizabeth, and the price of bows was again regulated by statute; also, bowyers were commanded to keep in hand always a sufficient stock of bows. Charles I. issued commissions to prevent the enclosure of fields near London, so "as to interrupt the necessary and profitable exercise of shooting with bows and arrows," and also for the restoration of all shooting-marks that had been already removed. And the earl of Essex, at the beginning of the civil war, raised a company of archers for the defence of the king.

There is now no means of ascertaining precisely the period at which the bow was relinquished entirely in these kingdoms as a weapon of war. Grose informs us that it was commonly used by the English soldiery for more than two centuries after the introduction of fire-arms, and indeed, long subsequently to the adoption of guns, the bow remained the favorite weapon of the army,—a fact which is not surprising when we learn, on the authority of Neade, a celebrated archer of Charles I., that the ordinary range of the bow was from 16 to 20 score yards, and that so rapid was the shooting of the archers, or so slow the firing of the musketeers, that an archer could shoot six arrows in the time occupied in charging and discharging one musket.

ARCHES, COURT OF THE. This court derives its name from its ancient place of judicature, which was in the church of St. Mary of the Arches (*de Arcubus*), the modern representative of which is now called ordinarily Bow Church. The modern church is on the south side of Cheapside, in the city of London, and stands on the site of a very ancient church, which was burnt down in the great fire of London in 1666, and which had a very fine arched crypt, whence it derived its name. The ecclesiastical tribunal, which has passed for a long time by the name of the Arches Court, is the court of appeal of the archbishop of Canterbury, as metropolitan of the province of Canterbury, and the proper designation of the judge is the Official Principal of the Arches Courts, but by custom he has come to be styled the Dean of the Arches, from the circumstance that the office of dean has been in modern times usually united in the same person with that of the official principal of the court of appeal. The office of the dean of the Arches may now be regarded as extinct, or at least as purely titular, like that of the dean of Bocking in Essex, inasmuch as the peculiar jurisdiction which he exercised as dean (*decanus*) over thirteen churches, locally situated within the diocese of London, but exempt from the bishop's jurisdiction, has been abolished, and the churches have been placed by statute under the ordinary jurisdiction of the bishop of London. It was, no doubt, owing to the circumstance that the Arches church was exempt from the bishop of London's jurisdiction that it was selected originally as the place of judicature for the archbishop's court. After the College of Advocates was incorporated and had established itself in Doctors' Commons, the archbishop's court of appeal, as well as his prerogative court, were usually held in the hall of the College of Advocates, but since the destruction of the buildings of the college, the court of appeal has had no settled place of judicature, and the official principal appoints from time to time its sittings, which have been held for the most part in Westminster Hall. The official principal of the Arches Court is the only ecclesiastical judge who is empowered to pass a sentence of deprivation against a clerk in holy orders.

ARCHIDONA, a town in the province of Malaga,

in Spain, situated on the slope of a hill, about 10 miles W.N.W. of Loja. It seems to have been a flourishing place under the Romans, to judge by the statues, columns, and other remains which are found, but it is now, in the words of O'Shea, a "wretched village with nothing to visit." The inhabitants, about 7600 in number, are employed in fruit-growing, weaving, oil-pressing, and bacon curing.

ARCHIL, or **ORCHIL** (*Orseille*, Fr.), a purple dye yielded by various species of lichens. The name is supposed to originate from the Portuguese *rocha*, a rock, in allusion to the source from which the raw material is derived. Archil can be extracted from many species of the genera *Rocella*, *Lecanora*, *Umbilicaria*, *Parmelia*, and others, but in practice two species of *Rocella*,—*R. tinctoria* and *R. fuciformis*, are almost exclusively used. These, under the name of "Orchella Weed," are imported from the Portuguese colony of Angola, on the west coast of Africa, where the most valuable kinds are gathered; from Cape de Verde Islands; from Lima, on the west coast of South America; and from the Malabar coast of India. They grow on maritime rocks and on trees along sea-coast, and it will be seen that the species are very widely distributed. The coloring properties of the lichens do not exist in them ready formed, but are developed by the treatment they receive at the hands of manufacturers. Small proportions of a colorless, crystalline principle, termed *orcine*, is found in some, and in all a series of acid substances, which on treatment split up into *orcine* and other products. *Orcine* in presence of oxygen and ammonia takes up nitrogen and becomes changed into *orceine*, which is essentially the basis of all lichen dyes. Archil is prepared for the dyer's use in the form of a "liquor" and a "paste," and the latter when dried and finely powdered forms the "cudbear" of commerce, a dye formerly manufactured in Scotland from a native lichen, *Lecanora tartarea*. The manufacturing process consists in washing the weeds, which are then ground up with water to a thick paste. If archil paste is to be made this paste is mixed with a strong ammoniacal solution, and agitated in an iron cylinder heated by steam to about 140° Fahr. till the desired shade is developed—a process which occupies several days. In the preparation of archil liquor the principles which yield the dye are separated from the ligneous tissue of the lichens, agitated with a hot ammoniacal solution, and exposed to the action of air. When carbonate of potassium or sodium is added, a blue dye known as *litmus*, much used in chemical testing, is produced. French purple or lime lake is a lichen dye prepared by a modification of the archil process, and is a more brilliant and durable color than the other. The dyeing of worsted and home-spun cloth with lichen dyes was formerly a very common domestic employment in Scotland; and to this day, in some of the outer islands, worsted continues to be dyed with "crotle," the name given to the lichens employed. Stale urine is the form of ammoniacal liquor used in these localities, and that in early days was the recognised source of ammonia in the manufacture.

ARCHILOCHUS, one of the first Greek lyric poets, was born at Paros, one of the Cyclades. The date of his birth is uncertain, but he flourished between 720 and 680 B.C. His father, Telesicles, was of noble family, and had been selected to consult the Delphic oracle relative to sending out a colony from Paros. His mother, Enipo, was a slave. While still young, Archilochus gained a prize for a hymn to Demeter; he soon after left Paros and proceeded to Thasos, according to some authorities, as leader of a colony. But his chief reasons for leaving his native place seem to have been personal disappointment and disgust. Lycambes had promised him his daughter Neobule in marriage, and had after-

wards withdrawn his consent. Archilochus, taking advantage of the licence allowed at the feasts of Ceres, poured out his wounded feelings in verses of unmerciful satire. Lycambes he accused of perjury and his daughters of leading the most abandoned lives. Such was the effect produced by his verses, that Lycambes and his daughters are said to have hanged themselves. The satire was written in iambics, a measure introduced for the first time, and from its structure admirably adapted for light sarcastic poetry. At Thasos the poet passed some unhappy years, and incurred the great dishonor of throwing away his shield and fleeing from the field of battle. He does not seem to have felt the disgrace very keenly, for, like Alcæus and Horace, he commemorates the event in his verses. After leaving Thasos he is said to have visited Sparta, but to have been at once banished from that city on account of his cowardice. His works, owing to their licentious character, were also prohibited by the Spartans. He next visited Siris, in lower Italy, a city of which he speaks very favorably. He then returned to his native place, and was slain in a battle against the Naxians by one Calondas or Corax, who was cursed by the oracle for having slain a servant of the Muses.

The writings of Archilochus consisted of elegies, hymns, —one of which used to be sung by the victors in the Olympic games,—and of poems in the iambic and trochaic measures. To him certainly we owe the invention of iambic poetry and its application to the purposes of satire. The only previous measures in Greek poetry had been the epic hexameter, and its offshoot the elegiac metre; but the slow measured structure of hexameter verse was utterly unsuited to express the quick, light motions of satire. Archilochus made use of the iambus and the trochee, and organised them into the two forms of metre known as the iambic trimeter and the trochaic tetrameter. The trochaic metre he generally used for subjects of a serious nature; the iambic for satires. He was also the first to make use of the arrangement of verses called the epode. Horace in his metres to a great extent follows Archilochus. All ancient authorities unite in praising the poems of Archilochus, in terms which appear to be somewhat exaggerated. His verses seem certainly to have possessed strength, flexibility, nervous vigor, and, beyond everything else, impetuous vehemence and energy. Horace speaks of the "rage" of Archilochus, and Hadrian calls his verses "raging iambics." By his countrymen he was revered as the equal of Homer, and statues of these two poets were dedicated on the same day. The fragments of Archilochus are to be found in the collections of smaller Greek poets by Jacobs, Bergk, and Gaisford, and have been published separately by Liebel, *Archilochi Reliquiæ*, Leipsic, 1812, 1818.

ARCHIMANDRITE (cloister, or convent), is a title in the Greek Church applied to a superior abbot, who has the supervision of several abbots and cloisters. The name has sometimes been applied generally to superiors of large convents. In Russia the bishops are selected from among the archimandrites. Although the title is peculiar to the Greek Church, it has found its way into Western Europe. It is used in Sicily, Hungary, and Poland, and has even been applied to bishops of the Latin Church.

ARCHIMEDES, the greatest mathematician and the most inventive genius of antiquity, was born at Syracuse, in Sicily, about 287 B.C. In his youth he went to Alexandria, and completed his education there under Conon, at the royal school of the Ptolemies, of which Euclid had been the ornament some half a century before. On his return to his native city he devoted himself to geometrical investigations, and by his great

energy and inventiveness carried the science far beyond the limits it had then attained. Combined with his remarkable faculty of analysis was a power of practical application which enabled him to establish the science of engineering upon a solid mathematical basis. Of the facts of his private life we have but a few disconnected notices. He was the devoted friend, and, according to some accounts, the relative of Hiero, king of Syracuse; and he was ever ready to exercise his ingenuity in the service of his admirer and patron. Popularly, Archimedes is best known as the inventor of ingenious contrivances, though many of the stories handed down about these are probably fabulous. He devised for Hiero engines of war, which almost terrified the Romans, and which protracted the siege of Syracuse for three years. There is a story that he constructed a burning mirror that set the Roman ships on fire when they were within a bow-shot of the wall. This has been discredited because neither Polybius, Livy, nor Plutarch mention it; mirrors may, however, as Buffon showed, be so arranged as to burn at a considerable distance, and it is probable that Archimedes had constructed some such burning instrument, though the connection of it with the destruction of the Roman fleet is more than doubtful. Among the most celebrated of his contributions to practical science are his discoveries in hydrostatics and hydraulics. The account usually given of one of these is remarkable. Hiero, it is said, had set him to discover whether or not the gold which he had given to an artist to work into a crown for him had been mixed with baser metal. Archimedes was puzzled till one day, as he was stepping into a bath and observed the water running over, it occurred to him that the excess of bulk occasioned by the introduction of alloy could be measured by putting the crown and an equal amount of gold separately into a vessel filled with water, and observing the difference of overflow. He was so overjoyed when this happy thought struck him he ran home without his clothes, shouting, "*εὕρηκα, εὕρηκα*,"—I have found it, I have found it. It may have been this that led to his establishing the fundamental principle still known by his name, that a body immersed in a liquid sustains an upward pressure equal to the weight of liquid displaced. Among a number of other mechanical inventions ascribed to him, the water-screw may be mentioned, which still bears his name. His estimate of the capabilities of the lever is expressed in the saying attributed to him, *Δός μοι σῶα, καὶ τὴν γῆν κινήσω*, "Give me a fulcrum on which to rest, and I will move the earth."

The life of this philosopher ends with the capture of Syracuse by Marcellus, 212 B.C. In the general massacre which followed the fall of the city, Archimedes, while engaged in drawing a mathematical figure on the sand, was run through the body by a Roman soldier. No blame attaches to the Roman general, Marcellus, since he had given orders to his men to spare the house and person of the sage; and in the midst of his triumph he lamented the death of so illustrious a person, directed an honorable burial to be given him, and befriended his surviving relatives. In accordance with the expressed desire of the philosopher, his tomb was marked by the figure of a sphere inscribed in a cylinder—the discovery of the relation between the volumes of a sphere and its circumscribing cylinder being regarded by him as his most valuable achievement. When Cicero was *quæstor* in Sicily (75 B.C.), he found the tomb of Archimedes, near the Agrigentine gate, overgrown with thorns and briars. "Thus," says Cicero (*Tusc. Disp.* v. 23), "would this most famous and once learned city of Greece have remained a stranger to the tomb of one of its most ingenious citi-

zens, had it not been discovered by a man of Arpinum." The range and importance of the scientific labors of Archimedes will be best understood from a brief account of those writings which have come down to us; and it may be remarked that though some useful and important works may have perished, it is probable that these are chiefly details of his mechanical inventions, and that all his most valuable mechanical discoveries have been preserved.

ARCHIMEDES, SCREW OF, a machine for raising water, said to have been invented by Archimedes, for the purpose of removing water from the hold of a large ship that had been built by King Hiero. It consists of a water-tight cylinder, enclosing a chamber walled off by spiral divisions running from end to end, inclined to the horizon, with its lower open end placed in the water to be raised by the screw within.

ARCHIPELAGO, a name which, though it is now applied to any island-studded sea, was formerly the distinctive designation of what, though still known as the Archipelago, is often distinguished as the Grecian Archipelago, namely, that part of the Mediterranean which lies between Greece and Thessaly on the W. and Asia Minor on the E.—the *Ægean* Sea of the ancients.

The other Archipelagoes, portions of ocean with numerous islands in close contiguity, as the Indian, Caribbean, Patagonian, &c., will be described in their respective places.

ARCHITECTURE (Latin *architectura*, from the Greek *architector*, a master-builder) is the art of building according to principles which are determined, not merely by the ends the edifice is intended to serve, but by considerations of beauty and harmony. It cannot be defined as the art of building simply, or even of building well. The end of building as such is convenience, use, irrespective of appearance, and the employment of materials to this end is regulated by the mechanical principles of the constructive art. The end of architecture as an art, on the other hand, is so to arrange the plan, masses, and enrichment of a structure as to impart to it interest, beauty, grandeur, unity, power. Architecture thus necessitates the possession by the builder of gifts of imagination as well as of technical skill, and in all works of architecture properly so called these elements must exist, and be harmoniously combined. The combination of technical with imaginative features removes architecture from the precise position occupied by painting, sculpture, and music, but does this more in appearance than in reality, since the greatest works of the architect must always be those in which the imagination of the artist is most plainly seen.

Like the other arts architecture did not spring into existence at an early period of man's history. The ideas of symmetry and proportion which are afterwards embodied in material structures could not be evolved until at least a moderate degree of civilisation had been attained, while the efforts of primitive man in the construction of dwellings must have been at first determined solely by his physical wants. Only after these had been provided for, and materials amassed on which his imagination might exercise itself, would he begin to plan and erect structures, possessing not only utility, but also grandeur and beauty. Before proceeding to inquire into the history of architecture, it may be well to enumerate briefly the elements which in combination form the architectural perfection of a building. These elements have been very variously determined by different authorities. Vitruvius, the only ancient writer on the art whose works have come down to us, lays down three qualities as indispensable in a fine building, viz., *Firmitas, Utilitas, Venustas*, stability, utility, beauty. In an architectural point of view the last is the principal though

not the sole element; and, accordingly, the theory of architecture is occupied for the most part with æsthetic considerations, or the principles of beauty in designing. Of such principles or qualities the following appear to be the most important: size, proportion, harmony, and symmetry, ornament, and color. All other elements may be reduced under one or other of these heads.

With regard to the first quality, it is clear that, as the feeling of power is a source of the keenest pleasure, size, or vastness of proportion, will not only excite in the mind of man the feelings of awe with which he regards the sublime in nature, but will impress him with a deep sense of the majesty of human power. It is, therefore, a double source of pleasure. The feelings with which we regard the Pyramids of Egypt, the vast monoliths at Rome, the massive temples of Sicily and the Parthenon, and the huge structures of Stonehenge, sufficiently attest the truth of this principle.

The qualities in the general disposition of the parts of a building which are calculated to give pleasure to the beholder, are proportion, harmony, and symmetry. To obtain a clear idea of the general plan in order to appreciate these qualities, the best method is to contemplate the building under conditions that prevent the mind from being disturbed by the consideration of the details—at a distance, for instance, or by moonlight, when its outlines may be seen standing boldly out against the sky. Thus the mass of a Gothic cathedral, the proportion of its parts, the outline of tower, nave, choir, and lady-chapel, the deep shadows which show the projection or recess of its various parts, are in themselves beautiful even when there is not light enough to distinguish mouldings, carvings, or tracery.

Proportion itself depends essentially upon the employment of mathematical ratios in the dimensions of a building. It is a curious but significant fact that such proportions as those of an exact cube, or of two cubes placed side by side—dimensions increasing by one-half (e.g., 20 feet high, 30 wide, and 45 long)—or the ratios of the base, perpendicular, and hypotenuse of a right-angled triangle (e.g., 3, 4, 5, or their multiples)—please the eye more than dimensions taken at random. No defect is more glaring or more unpleasant than want of proportion. The Gothic architects appear to have been guided in their designs by proportions based on the equilateral triangle.

By harmony is meant the general balancing of the several parts of the design. It is proportion applied to the mutual relations of the details. Thus, supported parts should have an adequate ratio to their supports, and the same should be the case with solids and voids. Due attention to proportion and harmony gives the appearance of stability and repose which is indispensable to a really fine building. Symmetry is uniformity in plan, and, when not carried to excess, is undoubtedly effective. But a building too rigorously symmetrical is apt to appear cold and tasteless. Such symmetry of general plan, with diversity of detail, as is presented to us in leaves, animals, and other natural objects, is probably the just medium between the excesses of two opposing schools.

Next to general beauty or grandeur of form in a building comes architectural ornament. Ornament, of course, may be used to excess, and, as a general rule, it should be confined to the decoration of constructive parts of the fabric; but, on the other hand, a total absence or a paucity of ornament betokens an unpleasant poverty. Ornaments may be divided into two classes—mouldings and the sculptured representation of natural or fanciful objects. Mouldings, no doubt, originated, first, in simply taking off the edge of anything that might be in the way, as the edge of a square

ARCHITECTURE.

ST. PAUL'S

and front elevation.



SCALE

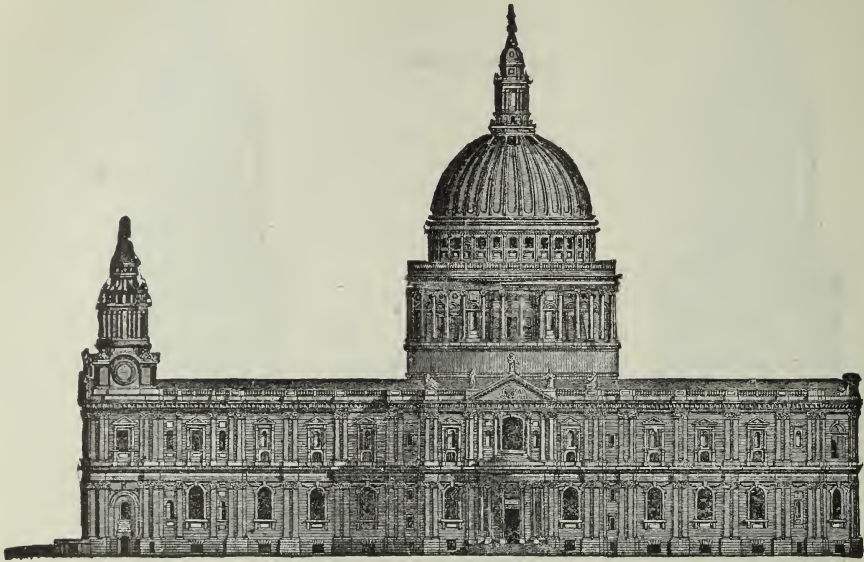
10 20 30 40 50 60 70 80 90 100 Feet.

ST. PETER'S.



East front elevation.

ARCHITECTURE



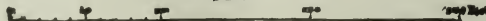
ST PAUL'S

(South-East Elevation.)



ST PETER'S
(North-East Elevation.)

SCALE



post, and then sinking the chamfer in hollows of various forms; and thence were developed the systems of mouldings we now find in all styles and periods. Each of these has its own system; and so well are their characteristics understood, that from an examination of them a skilful architect will not only tell the period in which any building has been erected, but will even give an estimate of its probable size, as professors of physiology will construct an animal from the examination of a single bone. Mouldings require to be carefully studied, for nothing offends an educated eye like a confusion of mouldings, such as Roman forms in Greek work, or Early English in that of the Tudor period. The same remark applies to sculptured ornaments. They should be neither too numerous nor too few, and, above all, they should be consistent. The carved ox skulls, for instance, which are appropriate in a temple of Vesta or of Fortune, would be very incongruous on a Christian church.

Color must be regarded as a subsidiary element in architecture, and although it seems almost indispensable and has always been extensively employed in interiors, it is doubtful how far external coloring is desirable. Some contend that only local coloring, *i.e.*, the color of the materials, should be admitted; but there seems no reason why any color should not be used, provided it be employed with discretion and kept subordinate to the form or outline.

As has been already pointed out, the origin of the art is to be found in the endeavors of man to provide for his physical wants. Man, in his primitive savage state, began to imitate the nests of birds and the lairs of beasts, and constructed arbors with twigs of trees. To these arbors succeeded huts with walls composed of dried turf, strengthened with reeds and branches. From huts to houses the progress is gradual and easy. Some writers have endeavored to trace three orders of primitive dwellings—the cave, the hut, and the tent—constructed severally by the tribes who devoted themselves to hunting and fishing, to agriculture, and to a pastoral and nomadic life. There can be no doubt that climate and surrounding circumstances affected not only the form of the primitive buildings, but also the materials employed. Thus, where trees abounded, stone was probably a material seldom used, as it entailed a much greater amount of labor than timber; but as stone would neither burn nor rot, it was preferred for all durable purposes. Where wood was plentiful, as in Greece and in Lycia, stone architecture exhibits traces of an original timber construction. The columns were originally posts, and the architraves and triglyphs beams resting on each other. The Lycian tomb in the British Museum furnishes a strong proof that there the art of the carpenter preceded that of the mason, and suggested forms, which became conventional, and from which the latter could not venture to depart. On the other hand, in the plains of Egypt, where building timber is scarce, and where there is abundance of large stone in the mountains, the mason element seems to have prevailed. In such plains as those of Nineveh and Babylon artificial stone was made from lumps of dried or burnt clay. Finally, in vast sandy deserts, where there are neither trees nor stones, the skins of beasts, sewed together and supported by sticks, formed the earliest shelter. This soon grew into the tent, and its form still influences the architecture of the Chinese and the Tartars. Much ingenuity has been expended in the inquiry whether it was timber or stone that first gave birth to the art of *architecture*; the probability is, that the hut, the cairn, and the tent, all contributed their share in different countries.

No traces remain of the steps by which the beautiful

temples of Egypt or the magnificent halls of Persia and Assyria were developed from these rude beginnings. The earliest known structures of those countries belong to an age already considerably advanced in civilisation and in the art of construction. And the history of architecture from its earliest specimens in Egypt is not one continuous line of progress. We can indeed show how from these early structures sprang the art of Greece; how that was modified by the Romans; and finally, how the Pointed architecture of the 13th century arose. But the development is not gradual; it proceeds by a series of steps, and one style does not shade imperceptibly into another. No doubt the architects of each country borrowed somewhat (in detail more especially) from the designs of the adjacent countries; but, nevertheless, each country originated forms peculiar to itself, and in all its artistic efforts continued to repeat and elaborate them. So definite are the characteristics of the styles of different nations, that from the mere form, carving, or decoration of any structure, its age and its architects can, usually, be fairly determined.

PREHISTORIC STRUCTURES.

The numerous relics of structures left by primeval man have generally little or no architectural value. The only interesting problem regarding them, the determination of their date and purpose, and of the degree of civilisation which they manifest, falls within the province of archaeology.

The principal specimens of such prehistoric erections may be classified thus—

(1.) *Monoliths* (*Maenhirs*, from *Maen*, a stone, *hir*, high), or single upright stones. The best example is at Carnac, in Brittany. This huge stone, when perfect, was 63 feet high, and 14 feet in diameter at its widest part. It is rudely shaped to a circular form, and weighs about 260 tons.

(2.) *Cromlechs*, table-stones, generally consisting of one large flat stone supported by others which are upright. The cromlech is also named *Dolmen*, from *Taal*, or *Daul*, a table, and *Maen*, a stone. A good example of the cromlech is the structure known as "Kit's Coity House," near Maidstone. Other examples occur in different parts of Great Britain and Ireland, and numerous specimens are found in Algeria, in India, in the country east of the Jordan, in Guernsey, and near Samur, on the Loire.

Circles of Stone.—The most important specimen of these in Britain is Stonehenge.

Tumuli.—These include the *beehive huts*, so called from their shape, found scattered throughout Cornwall, Wales, and Scotland. Similar, but superior, edifices are to be met with in Ireland; and of these, New Grange, near Drogheda, apparently a burial mound, is the finest specimen. The design of the "nurhags," which are found in great numbers in the island of Sardinia, has greatly puzzled archaeologists. It has been conjectured that they were sepulchres, the dead being exposed on their summits. Of the so-called "Picts' houses" of the Orkney Islands, some are chambered tumuli, while others may be more properly described as underground dwellings.

Wooden huts, the submerged remains of which have been recently discovered in the lakes of Switzerland, as well as in Sweden, in Italy and in Ireland. These erections, which rose on piles just above the surface of the water, present no features of architectural interest.

Prehistoric remains are separated by a wide gulf from those which now fall to be noticed, inasmuch as, whether or not they led, by improvement in their forms, to anything really architectural, no evidence remains of such progress, and they must therefore be regarded as

practically dissociated from anything that we have now to describe.

EGYPTIAN ARCHITECTURE.

For the beginnings of the art — its earliest efforts, grand even in their infancy — we must turn to Egypt.

A short description of the general configuration of the country may be useful here. Its habitable land is a narrow strip a few miles wide, extending from the Nile, on one or both its banks, to the rocks or desert. About 100 miles up the river is Cairo, and close to it Memphis, the old capital of Lower Egypt, Heliopolis, and the great pyramids of Ghizeh, Abooseer, Sakkara, and Dashour; 450 miles higher up the river is the site of the great Thebes, with Karnak and Luxor on the right or eastern bank, and Medinet Haboo on the west. Beyond this in succession are Esne, Edfoo, Elephantina, Syene, and Philæ, close to the first cataract. Higher up (in Nubia) are the great caves of Aboosimbel, and at a still greater distance, the pyramids of Meroë, or Dankelah. The rock is generally limestone up to Thebes, sandstone and breccia to Syene, where the well-known variety of granite, with hornblende, is found; these with the addition of unburnt brick, are the chief materials used in the construction of the Egyptian architectural monuments. The granite was principally supplied by the quarries at Elephantina and Syene, for which the Nile offered a ready mode of conveyance, although it appears that the obelisks and other enormous blocks were sent by land. Some species were brought down the river from Ethiopia, but we do not find that the materials were brought from any other foreign country. It may be remarked, too, that in the earliest structures the common *grès* or sandstone is principally employed. Excepting the obelisks and some few of the propylæa, all the temples at Thebes are of that material. In Lower Egypt, on the contrary, and in the works of later date generally, almost everything is constructed of granite.

It seems quite certain that Egyptian art is original and not derived from that of India; and it may be concluded with great probability that the structures of Egypt are the oldest specimens of architecture in the world. The origin of the structures themselves has been matter of some discussion. By several writers it has been thought that the rock-cut caves of Upper Egypt were the earliest efforts of architectural design, and furnished models for the enormous piles raised along the banks of the Nile. An examination of these caves, however, will show clearly that the very reverse is the case, and that the carvings of the excavations are imitated from the above-ground buildings.

The oldest works of the Egyptians, according to Herodotus, were the embankment of the Nile by Menes, the foundation of the city of Memphis, and the commencement of a temple to Vulcan. Next we learn from Manetho, as cited by Eusebius, that Venephes, the fourth king of the first dynasty, built some pyramids at a place called Cochomen, but this is all we know of them. Eusebius further records that Tosorthus, or Sosorthus, the second king of the third dynasty, found out how to build with polished or smooth stone.

The next structure of which we have notice is the Great Pyramid, the most gigantic work in the world — one which never has been, and perhaps never will be surpassed. At this time the Egyptians must have reached a proficiency in the mechanical arts of which we can form no conception. They seem to have been able to quarry rocks of the hardest stone, even granite — to transport them to great distances — to raise huge blocks, vast monolith obelisks, that would puzzle our engineers with their best tackle — and, more wonderful

still, they appear to have had the power not only of polishing granite, but of carving on that most stubborn material with the utmost facility, large surfaces and even huge statues being covered with hieroglyphics of the most minute kind and of the highest finish. It is impossible to discover how this was done, for though Herodotus (ii. 124, 125) tells us they had iron tools, it was long before the conversion of that metal into steel had been found out; and with all the best modern tools of steel, it is difficult and costly to carve even plain letters in granite. According to the account of Herodotus, the occasion of the erection of this great work was the caprice of the king, Cheops, who is supposed to be the Suphis of Syncellus, and the Chembes of Diodorus. This king was a tyrant of the very worst kind; he closed all the temples throughout Egypt, forbade every sort of religious observance, and forced all his subjects to labor for him as he pleased. Among other whims, he determined to build this pyramid as a tomb for himself. The stones were quarried in the Arabian mountains, and none were less than 30 feet long. They were then conveyed by the Nile to a newly-constructed road, three-quarters of a mile long, 60 feet broad, and in a cutting of 48 feet. This road, of polished stone, and carved with figures, took ten years to complete. Twenty years were spent in building the pyramid itself.

The site of this extraordinary structure is at Ghizeh, in the neighborhood of Cairo. The base was, Herodotus tells us, about 808 feet square, and the height the same. This, however, is not the case, the Greek author having probably measured the sloping edge. The dimensions are variously given by the various persons who have measured it. M. Nouet, who was of the French commission in Egypt, and had perhaps the best means of ascertaining the truth, states its base to be a square whose side is 716 French or 768 English feet, and gives the height as 421 French or 452 English feet. The dimensions of the pyramid in its original state, as given by Colonel Vyse, are 764 feet length of base, 720 feet slant side, and 480 feet high. The pyramid thus covers upwards of 13 acres, and is about 150 feet higher than St. Paul's cathedral. As compared with the largest building in the world, St. Peter's, Rome, the Great Pyramid covers an area which is as 58 to 22, or nearly three times as much, and is 50 feet higher. Like almost all the other pyramids, its sides face the cardinal points, and it is entered from the north by a descending passage, which leads to a few small chambers or cells, the largest of which is but 17.7 feet wide. In one of these a solitary sarcophagus was found. The pyramid appears to be a solid mass of stone, and is built in regular courses or layers, which vary in thickness from 2 to 5 feet, each receding from the one below it to the number of 202; though even this is variously stated from that number to 260, as indeed the height is given by various modern travellers at from 444 to 625 feet. This vast erection, on which the labors of 100,000 men were bestowed for twenty years, and which contains 85 millions of cubic feet of stone, must have cost (reckoning quarrying, transport — twice by land and once by river — squaring, hoisting, and setting at 50 cents per foot) something like 42½ millions of dollars.

A second pyramid, close to the first, was built by the successor of Cheops, whom Herodotus calls Chephren; the inscriptions on the stones, however, give the name Shafra. The side of its base is about 60 feet less than that of the former. About forty years later, Mycrinus or Mencheres, built a third; but the side of the base is only about 364 feet, or less than half that of the Great Pyramid. It was, however, entirely faced with polished granite, while the others were of limestone. A statue of King Chephren has recently been found in a temple

close adjacent to the pyramids, and now forms one of the most remarkable objects in the museum at Cairo.

The following seems to have been the manner in which the pyramids were generally constructed. A level platform was cut in the rock, a portion of which was, however, left in the centre above the general level to serve as a sort of core to the pyramid. A deep chamber was then sunk in the rock, with a passage leading from it always on the north side, and usually at an angle of 26° to 28° , to the surface of the ground. It is curious that these passages were almost always of one dimension, viz., 3 ft. 5 in. wide, and 3 ft. 11 in. high. Over the chamber was built a mass of masonry, which was gradually added to at the side and top, according to the power, or the wealth, or the length of life of the founder. Finally, the angles of the stones were cut off to the proper slope, or a casing added, and the pyramid thus completed from the top. Some of the casings were highly finished. Those of the first and second pyramid were of polished stone; that of the third was of polished granite. Occasionally, as in the Great Pyramid, and in the southern one at Dashour, there was a chamber built above the one which was cut in the rock. Their entrances were carefully concealed, and even the doors of the chamber defended by gigantic portcullises of granite, some 8 to 10 feet square, weighing 50 to 60 tons, so as to render the security of the chambers as great as possible. Yet every chamber in the chief pyramids, at least, except perhaps "the false one" at Mejdoum, has been rifled years ago, and so the great purpose of their erection utterly set at naught. The sarcophagus of the Great Pyramid, however, still rests in its chamber. An extra interest belongs to the third pyramid (of Mycerinus) owing to its chamber being ceiled with a pointed arch. But it is not a true arch, the stones being merely strutted against each other, as over the entrance to the Great Pyramid, and the underside cut to the above form. The chamber of a pyramid at Sakkara was lined with blue and white tiles like the Dutch style; and at the false one at Mejdoum there is, about two-thirds up, a band about 12 feet wide, left rough all round, and it has been supposed that this may have been left as a ground for decoration. The construction of pyramids seems to have ended in Lower Egypt at a very early date, with the old dynasty of Memphis. But some of crude brick, and containing arched chambers, are found at Thebes, and are supposed to be of date about 1200 B.C. Many similar structures, but on a very much smaller scale, were erected in Ethiopia and Meroë down to about 700 B.C.

Many theories have been stated as to the purposes for which these gigantic monuments were erected, but the opinion of M. Mariette, the latest, as well as one of the most learned writers, may be taken as correct, viz., that every pyramid was a tomb and the gigantic enclosure of a mummy. It is certain that every pyramid is on the western bank of the Nile, the region of the setting sun, and thus associated by the Egyptians with the regions of death, and that each group of pyramids is the centre of a necropolis.

Next to the pyramids in massive grandeur comes the Great Sphinx, and an additional interest has lately been associated with this statue, from the finding of an inscription, which seems to prove that it was sculptured before the time of the builder of the first pyramid. The Egyptian sphinx was quite different from the Greek, which usually had a female head on the body of a winged lion; whereas the Egyptian was wingless, and had usually the head of a man, bearded and capped, and thus represents strength and wisdom. The Great Sphinx at Ghizeh has the body of a lion crouching close to the ground; the height from the floor, or platform on

which it lies, to the top of the head is 100 feet; the total length is 146 feet; across the shoulders it measures 34 feet. The head, from the top to the chin, is 28 feet 6 inches, and is calculated to be 40,000 times the bulk of an ordinary human head. A small temple or sanctuary was built between its paws. With the exception of this, and the paws themselves, which are of masonry, the whole appears to be carved out of the solid rock. Indeed, it may safely be assumed to be solid; for Colonel Vyse drilled a hole 27 feet deep into the shoulder, and found that, so far at least, it was so.

Another grand memorial of the old dynasty must be mentioned, viz., the Serapeum, near the pyramid of Sakkara, discovered in 1851 by M. Mariette, and excavated 30 feet deep in the solid rock. It contains the mummies of the sacred bulls, placed in gigantic sarcofagi, 11 feet high, 7 to 8 feet wide, and 13 to 18 feet long, each of which is placed in a chamber. The chambers, forty in number, are excavated on each side of galleries about 12 feet wide, the ceilings being cut (not built) to the form of an arch.

No great distance beyond Sakkara, in the district called the Fayoom, was the famous Labyrinth, an immense mass of buildings mentioned by Herodotus as the palaces built for the twelve kings. From his description of it, this appears to have been as great a work and as great a wonder as the pyramids themselves. It was close to Lake Moeris, and contained in the time he wrote 3000 chambers, half above and half below ground, besides immense halls, corridors, courts, gardens, &c. The roofs were wholly of stone, and the walls covered with sculpture.

TOMBS.—The great reverence paid by the Egyptians to the bodies of their ancestors, and their careful preservation of them by embalmment, necessitated a great number and vast extent of tombs. Some of these, erected long after the building of pyramids had ceased, are built up above ground; others are caves cut in the sides of rocks; others are passages tunnelled under ground to a great extent. The most curious tomb at Ghizeh is known as Campbell's, of the supposed date of about 660 B.C. It is an open excavation, 53 ft. 6 in. deep, 30 ft. by 26 ft. 3 in. on plan, with niches, &c., leading out of it. In these were found four sarcophagi, one of which, of basalt, is in the British Museum. This excavation is supposed, from some indications left of a springing stone, to have been covered by an arch. If so, this would be the oldest known stone arch of a large size. In fact, it is difficult to imagine any other way in which this large excavation could have been covered. But the special object actually found was a tomb built up in the centre of the excavation, of good masonry, covered by three stones as struts, over which was a perfectly formed voussioired arch. This arch was destroyed not long ago by the Egyptian Government, in order to build a mill. Outside the whole excavation was a deep trench 5 ft. 4 in. wide, and 73 feet deep, from which branch out a number of chambers. This excavation was probably finished above with some such truncated pyramid as we have already described.

Even more interesting are the tombs of Beni Hassan and Thebes. There is little attempt at architectural decoration in these, but they are filled with the most interesting paintings, representing even the minutest incidents of private life. A model of one was exhibited in London by Belzoni; and there is a valuable series built up, and painted in fac-simile, in the Vatican at Rome. It appears that as soon as a king succeeded to the throne, the excavation of his tomb commenced, and proceeded year by year till his death. One of the grandest at Thebes is that of a priest, otherwise unknown to fame, which comprises a series of halls, pas-

sages, and chambers, at various levels, branching off in one place three different ways. In all, it is 862 feet long, and the part actually excavated occupies an area of 23,000 feet.

TEMPLES.—The Egyptian temples range from the time that Thebes became the capital (about 2000 B. C.) down to the time of the Cæsars.

Of all the temples, the most remarkable is perhaps the rock-cut one of Aboosimbel, in Nubia, supposed to have been excavated in the 14th century B. C. The façade was cut in the steep face of a rock, the entrance doorway being flanked by two gigantic statues (66 feet high) on each side. The main feature internally was a grand hall supported by two rows of detached piers, in front of each of which is a statue 17 ft. 8 in. high. Another remarkable temple exists at Ghizeh, built up within a great excavation in the rock; here was found the statue of Chephren before mentioned. The temple is lined with immense blocks of polished granite, as are also the piers, each of these being of one stone about 15 feet high, 5 feet wide, and 3.2 thick. Over this structure there was clearly another, above ground, as extensive remains of fine stone-walling still exist.

The grandest architectural efforts of the Egyptians are shown in their built temples, whose construction ranges from the time that Thebes became the chief capital (about 2000 B. C.) down to so late even as the time of the Cæsars. Sir Gardner Wilkinson, in his *Architecture of Ancient Egypt*, gives a very full account of these edifices, and classifies them thus:—1. *Sanctuary Temples*, or those with only one single chamber. 2. *Peripteral Temples*, or the like, but surrounded with columns. 3. *Temples in Antis*, with a portico of two or four columns in front. 4. Those with porticos of many columns, as Esne, Dendera, &c., and many inner chambers. 5. Those with large courts, and with *pyramidal towers* or propylons in front.

The temple at Edfoo, though its dimensions are considerable, is small when compared with that at Karnak. This covers about 420,000 feet, or five times as much as St. Paul's, London, and more than twice as much as St. Peter's at Rome. The propylon is 370 feet long, or twice as much as that of St. Paul's. The hypostyle hall, a parallelogram of about 342 feet long, and 170 feet wide, is the most wonderful apartment in the world. It has fourteen rows of columns, nine in each row, and 43 feet high; and two rows, six in each, of the enormous height of 62 ft., 11 ft. 6 in. in diameter, and carrying capitals which measure 22 feet across. This hall (with the two gigantic pylones) is said to cover 4000 superficial feet more than St. Paul's. Beyond it is the adytum or shrine, a small apartment, measuring only 26 feet by 16 feet.

STATUES.—Connected with the temples and forming an important part of their decorative features, were gigantic statues and obelisks. The statues are of enormous proportions. The sitting figure of Memnon is about 53 feet without the pedestal; and that in the sepulchre of Osymandyas (the Memnonium) is nearly 60 feet high. The face of Memnon is 7 feet high, and the ear 3 feet 6 inches long, and the shoulders measure nearly 26 feet across.

OBELISKS.—The obelisks of Egypt are generally huge monoliths of red granite or syenite. Their use originated, no doubt, in the custom of setting up stones to commemorate particular events. The Egyptians embellished these stones, first by working them to a fine face, and afterward by covering them with carvings. They stand frequently in pairs before the propylon of the temples, as at Karnak and at Philæ. After the conquest of Egypt the emperors transported many of these monu-

ments to Rome. At the time the celebrated *Regionaries* (accounts of each of the wards or *Regiones* of Rome) were written, there were six great obelisks, and forty-two small ones at Rome. Of these twelve only are now left, varying in height from over 100 feet to 8½ feet. The first, which now stands close to the church of St. John Lateran, is 148 Roman palms in height, or a little over 108 feet, is about 8 feet square at the base, and weighs, as is estimated, nearly 450 tons. It is covered with hieroglyphics, from which we gather it was erected in honor of Thothmes IV. It stood originally before the temple of Amen Ra, and was brought over by Caligula.

The Barberini obelisk is about 7¾ times as high as the diameter of the base; Cleopatra's needle, 8½; the one at St. Peter's 9 times, at Luxor 10 times, at the Lateran 11 times; while two at Thebes, and one in the Piazza Navona at Rome, have an altitude of no less than 12 times the diameter of the base.

Sir G. Wilkinson has classed Egyptian columns into eight orders. *First*, The *square pillar*, or post of stone. This often has a line of hieroglyphics running down it vertically. *Second*, The *polygonal column*, plain or fluted. This is sometimes painted, or otherwise ornamented with devices. *Third*, The *bud capital*, or one formed like the bud of the papyrus.

In the *fourth* order the capital is like an *inverted bell*. It formerly was called the *lotus capital*, but in reality it has no resemblance to that flower. The capital is so much undercut that the ornaments on its edge are not visible, except to a spectator who is immediately beneath them.

The *fifth* order is the *palm tree column*, and resembles the head of that tree, with the lower or drooping boughs cut off.

The *sixth* order is called the *Isis-headed order*, the capital being formed of one or more heads of that deity, surrounded by a representation of a doorway, or small shrine with an image, and sometimes a votary worshiping placed over it.

The *seventh* is called the *composite order*. The shafts are generally round, and the capitals, as the name imports, are a mixture of styles. The bell and palms, or the palm and the Isis head, are frequently found in combination. A most curious instance is ranked under this style, of columns of the third order with inverted shafts, and also inverted capitals, taken from Karnak, the work of Thothmes III.

The *eighth* order is called the *Osiride*, from containing statues of the deity Osiris. This order is something like the Persian, or the Caryatides of the Greeks and Romans; but it differs, inasmuch as the figure does not support the entablature, but stands in front of a square pier which discharges that duty.

PILASTERS.—These are employed in all ages, though they do not always accord with the order of the columns. For instance, at Thebes the pilasters of the Temple in *antis* of Dayr el Medeenah are of the sixth or Isis-headed order, while the columns between are of the seventh or composite order. They are generally square, and without diminution.

ENTABLATURES.—These are nearly alike in all orders, and may be described as a cornice and architrave without a frieze. The former consists of a fillet or regula, beneath which is what is generally called a large hollow or cavetto; but in reality the upper half is a quarter round, and the lower nearly straight. Under this moulding is a bold torus which separates the cornice from the architraves, and runs down the sloping sides of the angle of the building to the ground. The cornice is generally ornamented with divisional verticle lines, like triglyphs. Between these the car-

touches or ovals of the reigning monarch, or other devices, are carved. The centre is generally occupied by the winged globe, or emblem of the Good Dæmon. The torus is often ornamented as if strings were bound round a bundle of sticks, like the *fascies* of a Roman lictor. On the upper part of the smaller cornices there is often a row like the antefixæ of a Greek temple, but their form is peculiar, and is supposed to represent the pots in which the mummies of the sacred cats and ibis were preserved. The architraves are plain, without being broken into fasciæ, and are generally covered with hieroglyphics.

FORTIFICATIONS.—Next to the temples, the grandest buildings were perhaps the fortifications. We know that the temples themselves were often used as citadels, few of the towns being fortified. Even Thebes seems not to have been so. Of the actual citadels we have a few remains, as at Dakkeh. But several are shown on the drawings, and bear a curious resemblance to mediæval works, the ramparts of the walls and towers having battlements which overhang like our machicolations, while, in the centre of the enclosure formed by the walls, was generally a high square tower or keep. Of the further details we know little.

Although we have only ruins to guide us (for no man living has seen an Egyptian temple as it appeared to the old Egyptians), yet we can gather that to the Egyptians we owe the earliest examples of columnar architecture, and at the same time that they had not got beyond the rudiments of it. The stable effect of their massive columns disappears when we notice that scarcely any, except those of very recent date, have the wide-spreading base which we know so well in every other style; that the massiveness of the column is in fact wasted, as the lower part is rounded off and cut away so as to render $\frac{1}{4}$ th of it simply useless; and that the bold projecting capital carries no weight, and adds nothing to the strength of the stone beam above it, for that beam rests on a small block of stone *above* the capital, borrowing no strength whatever from it. It will also have been noticed, that nearly every Egyptian work is rectangular in plan, and that in exceptional cases, as, *e.g.*, the buildings at Philæ, Kalabsche, and Luxor, no attempt has been made to soften down the harshness of the lines. With the elevation it was the same. The square was never changed into the circle or the octagon. Nearly every form is bounded by the rectangle, and the only varieties found in the grandest of the buildings in Egypt are the slope of the massive pylon and the tapering obelisk. The minaret and the dome, which give such charming variety of outline, and the varied mouldings, without which it now seems to us that no building could be perfect, were unknown to the Egyptians. But of all things, the neglect of the arch is the most curious. Crude brick arches are found at least as early as the 16th century B.C., and others have been found of the same date, it is thought, as the pyramids. Yet the Egyptians of later times systematically employed enormous stones for their coverings and lintels, and left the arch unused. We must remember, in justice to the Egyptians, that their efforts in art were fettered, to an extent which we are perhaps unable to appreciate, by the restrictions imposed upon them by conventionalities connected with their religion. That they were so fettered in sculpture at least is abundantly clear from many examples. The freedom which characterises one of their earliest statues, that of King Chephren, the exquisitely bold yet delicately graceful sculptures in the Serapeum and in the tomb of Tih at Sakkara, and other examples, show clearly that the Egyptians had a power for design and execution which only such a cause as that referred to above could have suppressed.

JEWISH ARCHITECTURE.

The long sojourn of the Jews in Egypt, and the fact that their chief employment there seems to have been the manufacture of bricks, must have made them acquainted with the architecture of that country. On the conquest of Canaan, the Israelites seem to have taken possession of the dwellings of the vanquished people; and we have no record of any important building constructed by the Jews till the days of Solomon. The king therefore applied to Hiram, king of Tyre, with whom he was on friendly terms, and that monarch sent an architect and staff of skilled workmen. Materials were collected for the building, and careful accounts of the whole work are given in the books of Kings and of Chronicles.

The early temple is described (1 Kings vi. vii.) as a building of stone, roofed and floored with cedar. It appears to have been rectangular, with a single roof, and divided into two parts by a wall. It was 60 cubits long, 20 wide, and 30 in height, or about 110 feet by 36 feet, and 55 feet high. In front was a porch the same width as the temple (20 cubits), but only 10 cubits in depth.

In the prophecy of Ezekiel (ch. xl. *sqq.*) we have a very full and interesting account of what the temple was in his time. The house itself and the oracle do not appear to have been altered, but the old courts seem to have been swept away and succeeded by vast atria, and a mass of halls and chambers.

In the time of Cyrus the temple was rebuilt, but this second temple was demolished by Herod, who constructed a new one of the same dimensions as that of Solomon. The outer house was 40 cubits long, and the Holy of Holies 20 cubits; but it was nearly double the height of the first temple. The porch also, instead of being the width of the house, 20 cubits, was 100 cubits long and 100 high, crossing the temple in the form of a T, and forming a magnificent façade much longer than that of St. Paul's in London. Round the house were three stories of priests' chambers. The court had three entrances on each side, which were called respectively the water-gates, the fire-gates, and the oblation-gates. But the peculiar difference between Herod's temple and the earlier building was that there was, in front of the court last described, another of about the same size, surrounded by a colonnade and chambers, which was the place set apart for the women. These courts were surrounded by an outer court, having a species of cloister on the north, east, and west sides, composed of a double row of columns. On the south side was a similar construction a furlong in length. It consisted of three rows of columns, forming with the outer wall three aisles — the two outer being 30 feet wide and 50 feet high; the centre being 45 feet wide and 100 feet high — no doubt with a species of clerestory. These columns are described to have been so large that it took three men with extended arms to span their circumference. The outer court was elevated six steps above the basement level; the inner courts stood on a sort of plateau, with retaining walls and parapets round it, which was ascended by fourteen steps; this was on the level of the women's court. Between this and the inner court was a gate called that of Nicanor, in front of which was a semicircular flight of fifteen steps. The temple itself was entered by a flight of twelve steps, so that its floor must have been between 20 and 30 feet above the ground-level of the surrounding city. The whole was built of the most beautiful white marble.

The excavations recently made, at the expense of the Palestine Exploration Fund, have disclosed considerable remains of the massive ancient masonry, and of the cisterns, conduits, &c. But, with these exceptions, no

part of old Jerusalem appears to be extant. There are, however, some objects, formerly considered to belong to Jewish times, that should be mentioned. There are, first, what are called the tombs of the kings of Judah. These are a number of sepulchral chambers hewn out of the solid rock, and containing sarcophagi. They vary from 10 to 20 feet square, and are entered, exactly like the tombs of Beni Hassan, by a portico *in antis*, about 40 feet wide. There are two columns and two pilasters in front, of Greek Doric character, about 13 feet high. The most curious feature of these is, that a broad band, about 3 feet wide, richly sculptured with foliages, runs down on each side 4 or 5 feet and over the columns horizontally. Above this last, quite independent of the lower construction, is a regular Doric architrave and frieze, of a character between Grecian and Roman; this is ornamented with triglyphs, pateræ, and foliage. In front of the portico is a large court-yard, about 100 feet square.

In the Valley of Jehoshaphat, near Jerusalem, are three extremely curious relics; two stand alone, on platforms excavated from the rock, and the third is scarped into the rock itself. The first is called the tomb of Absalom. It is a square building with a solid wall, in which are engaged Ionic columns, about 13 feet high; over this is a Doric entablature with triglyphs, and an altar, surmounted by a very curious sort of hollow-sided cupola of trumpet-mouth section, and a terminal. The whole, including the flight of steps, is about 60 feet high.

From the character of the architecture it is incredible that these buildings can have anything like the age ascribed to them. The Ionic capitals are evidently Roman, and therefore cannot date earlier than the conquests by that people; probably they are of the time of Herod; while the Egyptian cornices show that the traditional ornaments of that people had not been entirely forgotten. Besides this, the general plan of a temple, *in antis*, scarped into a rock, so entirely resembles the work at Beni Hassan, that it is impossible to deny that these very interesting remains strongly corroborate the views of Canina, that the architecture of the early temples was at least based on the architecture of the Egyptians.

INDIAN ARCHITECTURE.

Considerable light has been recently thrown upon the history of architecture in the East. The traditions as to the extremely remote antiquity of the rock-cut temples, the caves of Ellora, and the wonderful pagodas, have disappeared before the searching eye of critical investigation. In the time of Herodotus the Persians had no temples; and even in that of Tacitus, the great Indo-Germanic races "would not confine their gods within walls." The early religion, which appears in the Vedas, was Brahminism, but in the 6th century B.C., the first of the Buddhas seems to have commenced a perversion of the ancient faith. The struggle appears to have gone on for years, till three-quarters of a century after the time of Alexander the Great, about 250 years before the Christian era, when a powerful ruler named Asoka, a grandson of Chandragupta, who is supposed to be the Sandracottus of the Greek writers, abjured Brahminism, and made Buddhism the religion of the state. Certain *Lats*, or pillars, erected by him, and inscribed with his edicts, are the earliest extant architectural remains of India.

The Buddhist topes are supposed to have been erected at first to commemorate some event, or to show that the spot was sacred; but after a time they were employed to contain relics, such as the tooth or collar-bone of one of the Buddhas. The relics seem in some cases to have been preserved in a sort of box or case at the top of the tope, called a *tee*; in others, in regular relic chambers.

Where there were relics, the place was called *dagoba*, or relic shrine, of which, perhaps, our term pagoda is a corruption. A great number of these topes were built in the form of large towers, others in the form of hemispheres. One of these, the Sanchi tope, is described and figured by Mr. Fergusson. The diameter is 106 feet. It has a curious species of gate entrance, and is surrounded by a stone fence. Others are partly cylindrical, and are finished with either a flat circle, or pointed terminals like a dome at the top.

Of the next two classes of Buddhist architecture, the temples (*Chaityas*) and monasteries (*Viharas*), no built examples exist in India. They are, in fact, rock-cut caves. At least one thousand temples are known—one-tenth probably Brahminical or Jain, the rest Buddhist. They are said to form an uninterrupted series, from the first, in Behar, by the grandson of Asoka, 200 years before Christ, to those at Ellora, which, instead of being of an almost diluvian antiquity, as has generally been reported, have been proved to date from the 7th or 8th century of our era, while the most recent is the work of Indra-dymna, as late as the 12th century. One of these cave-temples at Karli, near Bombay, presents exactly the features of a Roman basilica, or early Christian church. It has a circular end or apse, and is divided into three aisles by two rows of columns. Others are simple square buildings, with a circular or oval chamber at the end entered by a small door. The monasteries, which exceed the temples in number, seem generally to have been square caves supported by pillars of the natural rock left in their places, and surrounded by a number of small sleeping-places or cells.

The most wonderful excavations are those at Ellora, near Aurangabad. These are a series of hypogæa or caves sunk in the solid rock, extending a distance of 3 or 4 miles. Canina has given plans and interior views of six of them. Those called Parasova Rama and Dajanata are simply halls supported on massive piers with level architraves. The piers are richly carved with figures and friezes, and have a sort of cushion capitals, and square abaci, and stand round, forming a kind of atrium. That called Indra has a court open to the sky, in which is a small shrine or temple. In the solid rock are two halls similar to those above described, a larger and smaller. The piers of the Tin Tal are quite plain. In the Visvakarma is a quadrangle, open to the sky and surrounded by pillars. This leads into an atrium with three aisles and an apse, and exactly like a basilican church. The most magnificent of the Ellora caves, and indeed of the native Hindu works, are the chambers and halls called the Kylas, or Kailasa. These are sunk into the rock, and occupy a space of 270 feet deep and 150 feet wide. The roofs are solid rock, supported by pillars, or rest on the walls; or on the divisions of the assemblage of chambers. There is a porch, on each side of which are two columns. This conducts into a hall, supported on 16 such columns, and leading into a sort of adytum. Round this is passage space and five chambers. The whole forms a temple, with its usual appendages, just such a one as would be built on the ground, and round this a wide open space, with a colonnade or cloister encircling the whole. Great part is open to the sky, for the sake of light and air, but the work is entirely cut out of the solid rock.

The date of the construction of the Kylas is about 1000 A. D.

The earliest existing work of the Jains seems to be of the 10th century. They were a sect which arose in the endeavor to re-establish Brahminism, and which first seems to have acquired importance about 450 A. D. This sect rejects the doctrines of Buddhism, as also the practice of monasticism. The famous temple at Som-

nauth belongs to them. Mr. Fergusson has given a description of that built by Vimala Sah, on Mount Abu, as a type of the ordinary Jain temple. In the centre is a cell in which is a cross-legged figure of one of the twenty-four saints worshipped by this sect; in this case it is that of Parswanath. The cell is always terminated by a pyramidal roof. In front of this is a portico of 48 pillars, disposed much like a cruciform church with a dome at the intersection of the transepts. The whole is surrounded by a species of cloister formed by double rows of columns, and a series of small chambers like the cells of a *vihara*. But as the sect abjure monasticism, each cell is used not as a dwelling, but as a kind of small chapel, and contains one of their cross-legged deities. One of the peculiarities of this style is that richly-carved brackets spring from the pillars at about two-thirds of their height, and extend to the architraves, forming a sort of diagonal strut to strengthen and support them.

The Jains probably adopted the dome at a very early period, and it is doubtful whether the Buddhists ever used this species of construction. "No tope," Mr. Fergusson observes, "has the smallest trace of such a structure, though of domical shape outside, and the design of the rock-cut temples, with the upright supports, the raking struts, and the level architraves, has manifestly been deduced from timber construction." The Indian dome has no voussours radiating from the centre, as in European architecture. The courses are all horizontal; and the domes are therefore necessarily pointed in section, for they would not stand if circular. The Indian dome, however, has this merit, it requires no abutments, and has no lateral thrust. The pressure is entirely vertical; and if the foundation be sound, and the pillars stout enough, there can be no failure.

The leading idea of the plan of the Jain temple is that of a number of columns arranged in squares. Wherever it was intended to have a dome pillars were omitted, so as to leave spaces in the form of octagons. By corbeling over the pendentives in level courses the dome was gradually formed. The plan and view of the temple at Sadree exhibit a building as large as most cathedrals. It has the great number of 20 domes, varying from 36 feet to 24 feet in diameter, and supported by 420 columns.

Like most architectural peoples, the Jains were also fond of tower-building. The *Jaya Stamba*, a tower of victory erected by Khumbo Rana, to commemorate the defeat of Mohammed of Malwa, in 1439, is nine stories high, the two topmost stories being open. The general outline is not unlike that of an Italian campanile, with pilasters at the angles, and an overhanging corbelled top. It is richly ornamented from bottom to apex, and affords a very favorable idea of Indian art.

Hindu architecture has been divided into that of the Aryan or Sanscrit races of North India, that of the South or of the Tamul races, and that prevalent in the Panjab and Cashmere. Of the first and last we have comparatively little knowledge, but South Hindu work is treated of at great length by Rām Rāz, a native author. The great pagoda at Tanjore, by far the grandest temple in India, resting on a base 83 feet square, rises in fourteen stories to a height of nearly 200 feet.

Of the style of North India Mr. Fergusson gives remarkable, and by no means elegant, examples; as the Black Pagoda at Kannaruc, and temples at Barolli and at Benares. The chief features are a sort of entrance porch, sometimes walled and sometimes carried on pillars, called the nuptial hall, leading into a great pagoda, square in plan, and finishing with a sort of tub-shaped dome. The ornamentation is profuse, so much so as to detract from the greatness of the design. There are no

buildings in this style anterior to the Mahometan conquest. The date assigned to the temple of Jugernath is 1198, and to the Black Pagoda, 1241 A.D. The ghâts, or landing-places that line the banks of the rivers of Northern India, are often of great architectural merit.

The pagoda forms a very prominent feature in the architecture of Further India.

ASSYRIAN ARCHITECTURE.

Assyria and Babylonia or Chaldea may be shortly defined as the countries watered by the Euphrates and Tigris, lying between Armenia and Arabian desert, and reaching down to the Persian Gulf.

The capital, Ninus or Nineveh, was taken by the Medes under Cyaxares, and some 200 years after Xenophon passed over its site, then mere mounds of earth. It remained buried until 1845, when Botta and Layard discovered the ruins of the Assyrian cities. The principal remains are those of Khorsabad, 10 miles N.E. of Mosul; of Nimroud, supposed to be the ancient Calah; and of Kouyunjik, in all probability the ancient Nineveh. In these cities are found fragments of several great buildings which seem to have been palace-temples. They were constructed chiefly of sun-dried bricks, and all that remains of them is the lower part of the walls, decorated with sculpture and paintings, portions of the pavements, a few indications of the elevation, and some interesting works connected with the drainage, &c.

The structures were built usually on artificial mounds, and approached, it is supposed, by great flights of steps (of which remains composed of black basalt have been found at Khorsabad). They consist of series of halls and chambers of no great size, the largest hall in Sennacherib's palace at Kouyunjik being only 200 feet by 45 feet, whereas Westminster Hall is 268 feet by 68 feet. In their proportions they are utterly unlike Egyptian structures, and they display the striking peculiarity of being elongated beyond anything known in other styles of architecture; e.g., one of the Kouyunjik halls is 122 feet long by 27 wide, another is 218 feet long by 25 wide. The great hall at Nimroud, though 162 feet by 62, was divided lengthwise in the centre by a wall 12 feet thick, leaving each side only 25 feet wide. Another peculiarity of these structures is the immense thickness of the walls. Those of the Rouyunjik hall (27 feet wide) were 15 feet thick, and those of Nimroud (32 feet wide) were 26 feet thick. It has, indeed, been reckoned by Mr. Fergusson, that in some of the palaces the area of the walls is as great as that of the chambers. The reason he suggests for this is that these thick walls supported a double row of columns as a clerestory under the roof, so arranged as to give light and air, while excluding the rays of the sun. He covers the halls with flat roofs, supported on columns, which being of wood have rotted or been burnt. An entirely different theory is that of M. Flandin, who studied the subject on the spot. He believes that the halls were vaulted and had small windows at the springing. M. Victor Place has found at Khorsabad several vaults, and also terra cotta tubes, through which he believes that the vaults were lighted, just as domes were in Persia in later times. But no vault has been found large enough to span any of the wide Assyrian halls. Of their elevations there are few traces remaining. At Nimroud, what is supposed to be the tomb of Sardanapalus has its lower part, which is about 20 feet high, of solid masonry, and the rest of burnt bricks. It has slightly projecting piers, but no ornaments or mouldings. At Khorsabad and the S.E. palace of Nimroud there is some attempt at decoration, by rude semi-columns, without capitals or bases, arranged in clusters of seven, side by side, the groups being separated by recesses. A few detached pieces of moulding have been

found at Khorsabad, but of the very simplest kind, and we have no vestiges of capital or entablature. Were our knowledge limited to these and a few similar remains, we should have to form but a poor idea of Assyrian art. But the sculptures have revealed to us a degree of refinement which had been previously looked for only in Greece. These sculptures lined the sides of the halls to a height of 10 feet. In them we see columns with both base and capital, and surmounted by entablatures. Sometimes the columns are combined with pilasters, as in the Greek porticos *in antis*. In one specimen the columns were carried on the backs of bulls, as is shown by one of the bas-reliefs, and, more conclusively still, by the beautiful small model of a winged bull brought to England by Mr. George Smith, which has carved upon its back a base, just as is shown on the slabs.

The plans of all the Assyrian buildings are rectangular, and we know that long ago, as now, the Eastern architects used this outline almost invariably, and upon it reared some of the most lovely and varied forms ever devised. They gather over the angles by graceful curves, and on the basis of an ordinary square hall carry up a minaret or a dome, an octagon or a circle. That this was sometimes done in Assyria is shown by the sculptures. Slabs from Kouyunjik show domes of varied form, and tower-like structures, each rising from a square base. The resemblance between the ancient form of the dome and those still used in the Assyrian villages is very striking. Whether sloping roofs were used is uncertain. Mr. Bonomi believes that they were, and a few sculptures seem to support his view. Of the private houses nothing, of course, remains; but they are represented on the slabs as being of several stories in height, the ground floor as usual having only a door and no windows. All have flat roofs, and we gather from one of the bas-reliefs, which represents a town on fire, that these roofs were made, just as they now are, with thick layers of earth on strong beams. These roofs are well-nigh fire proof, and the flames are represented as stopped by them, and coming out of the windows. No remains of a window, or, so far as we are aware, of an internal staircase, have been found.

Of the fortifications we know much more. In the north wall of Nimroud fifty-eight towers have been traced, and at Kouyunjik there are large remains of three walls, the lower part being of stone, and the upper of sun-dried bricks. At Khorsabad there are the remains of a wall, still 40 feet high, built of blocks of stone 3 to 4 feet thick, and the evidences wanting as to the finishing of these is completely supplied by the sculptures, which show an extraordinary resemblance to mediæval works of the same class. Tier upon tier of walls are represented, enclosing a great tower or keep in the centre. The entrances are great arched gateways flanked by square towers. These and the other towers have overhanging parapets just like the mediæval machicolations, and are finished at top with battlements, remains of which have been found at Nimroud and Kouyunjik, and at Kaleb Shergat, the supposed capital of Assyria before Nineveh.

Of temples distinct from the palace we have a few supposed remains, but little is absolutely known as to their general form.

But in Chaldea there are some enormous masses of ruins, evidently remains of the vast mounds which formed the substructure of their temples. The grandest of all these and the most interesting is the Birs Nimroud, near Babylon, which has been identified as the temple of the Seven Spheres at Borsippa. This was reconstructed by Nebuchadnezzar, as appears by a well known inscription. Another example is at Mugeyer, which was 198 feet by 133 feet at the base, and is even now 70 feet high, and it

is clear that both it and the Birs were built with diminishing stages, presenting a series of grand platforms, decreasing in length as they ascended, and leaving a comparatively small one at top for the temple cell. This has been found, it is supposed, at the Birs Nimroud, of vitrified brick.

The most interesting parts of the Assyrian edifices are the finishings. The pavements were sometimes of sun-dried bricks, at other times of baked bricks, or of alabaster slabs laid in bitumen. At Khorsabad there was one in a single block 13 feet square, and 3 ft. 11 in. thick, and at the Nimroud temple there were two slabs, one 19 ft. 6 in. by 12 feet, and the other 21 feet by 16 feet, and 1 ft. 1 in. thick, both sides covered with inscriptions. Of ornamental pavements there are admirable examples from Kouyunjik at the British Museum, and from Khorsabad at the Louvre, both covered with delicate carving in alabaster of nearly the same pattern. It is difficult to conceive how such delicate work could have been used as paving, and still retain its beautiful sharpness; for it was not filled in to protect the pattern. Directly above the pavement came the sculptured slabs, which are so numerous that at Kouyunjik alone there are some two miles in length of them. They are generally about 10 feet high from the ground, and are carved in alabaster. Many of them show traces of having been decorated with colors. Connected with these sculptures were the great winged animals which stand one on each side of the portals of the palaces. Some of the grandest have the body and legs of a bull, with an enormous pair of wings projecting from the shoulders, high over their backs, and covering the breast. They have human heads, bull's ears with large ear-rings, and horns, winding from the brows upwards, and encircling a coronet of leaves, bound by a fillet of roses. They stood in pairs on each side of the palace doorways, and it is thought by some that generally there were no doors or lintels, all being open to the roof and enclosed with curtains. But doors were sometimes used, as the places or recesses for the bolts, hinges, pins, or sockets have been found; and Mr. Smith has discovered a doorway with its actual lintel, now in the British Museum.

In Assyrian art generally there is little analogy to that of Egypt. There is some slight resemblance in the mouldings and in a few of the ornaments, but in Assyria there are no forests of columns, no grand pylons, no enormous cloistered court, and nothing to equal the gigantic pyramids or tombs of Egypt. The sphinx is superseded by the winged bull, and the slightly cut intaglio by the magnificently sculptured slab. In these early Assyrian structures there is art at a high stage of perfection, but we have no means of discovering the steps by which it was attained.

PERSIAN ARCHITECTURE.

Persia was one of the greatest of ancient nations. At one time it embraced all Upper Asia, and Asia Minor, Phœnicia, Egypt, Thrace, and Macedonia, and though the greatness of its glory has departed, it was still a great living nation even in the 18th century, when its king Nadir Shah invaded India. Compared with Egypt, Assyria, and Babylonia, long since extinct, it has had a wonderful existence, reaching down from Cyrus to our own time.

Of the early times of the empire no authentic remains exist, except those of the tomb of its founder, Cyrus, at Murgab or Pasargadæ (east of the head of the Persian Gulf), and some of the walls, &c., of the ancient capital, Ecbatana, in North Media. The former is still in a wonderful state of preservation, but it can scarcely be reckoned amongst Persian edifices, as it is clearly a work designed by some architect from a

Greek colony of Asia Minor. The tomb stands on seven bold steps of white marble, the lowest being 43 feet by 37 feet. The tomb itself is 21 feet by 16 ft. 5 in. outside, with bold mouldings to the door; it has a sloping roof of marble, with a pediment at each end, enriched with mouldings. The chamber itself is only 7 feet by 10, the walls being built up with thick blocks of marble. Near the tomb was the famous inscription, "I am Cyrus the king, the Achæmenian," and though this is now wanting, recent discoveries seem to have disinterred the stone which had borne it, and which had been torn away. Round the tomb outside had evidently been a colonnade of 24 columns, fragments of which, with the bases, also remain. They resemble those commonly used by the Greeks. This singular structure seems to have been unique in Persia. It is evidently the work of a foreigner, although the outline may represent, as is supposed, a temple. The famous walls of Ecbatana, the ancient capital, are said to have been 75 feet broad and 105 high, its stones 9 feet by 4 ft. 6 in., and its gateways 100 feet high and 60 wide. The remains, however, show walls only 12 feet wide, stones only 2 feet by 1 ft. 2 in., and a gateway only 12 feet high and 10 feet wide. They deserve particular mention on account of their being among the earliest examples of constructive coloring on a grand scale. The walls are said to have been seven in number, one over the other on the sides of a conical hill, and colored in succession, white, black, scarlet, blue, orange, silver, and the innermost gilt. From what has been discovered at Warka (in ruins) it is possible that this gorgeous description may have been founded on fact; and we know that the Easterns in early times were profuse in their employment of glazed colored bricks.

Some 50 years after Cyrus, the chief buildings at Persepolis and Susa were constructed; large portions still remain, and form some of the grandest ruins in existence.

The existing buildings at Persepolis occupy a remarkable position on an elevated platform (partly, it would seem, artificial) at the foot of a steep rock in the face of which were cut out the tomb chambers of the Persian kings. The platform was 1425 feet on the west side, and 926 feet on the north, about the size of the Horticultural Gardens in London, including the arcades and conservatory. It was raised about 40 feet above the level of the adjoining country, and faced with a wall, built with stones of an immense size. The platform was approached by the grandest flight of steps in the world, each step being 22 feet long. Having scaled these, the stranger would pass through the first building viz., the Propylæum of Xerxes, a building whose remains have given rise to several theories as to its original plan and purpose. There remain two grand gateways 24 feet apart, with portions, more or less perfect, between these, of four columns 45 feet high. The gateways had openings of 13 feet, and each of the piers was partly composed of bulls, admirably executed, and strikingly like the Assyrian sculptures at the Louvre from Khorsabad. The human heads of these animals are crowned with coronets of leaves, and from the top of the coronets to the hoofs, the animal measures 19 feet. Through this structure was the entrance to the grand palace, the Chehil Minar, i.e., hall of 40 columns, an Eastern mode of expressing a great many, as there were really 72. It was approached by a magnificent staircase, each step of which served as a pedestal to a figure (1 ft. 9 in. high) in bas-relief, the whole representing a procession, and of great value as giving the varied costumes, &c., of the period. The columns of the palace are arranged in four divisions, viz., one of 36 columns in the centre, and three each of 12 columns in two rows, divided from the centre by a space of about 60 feet. Of all these only 10 are

standing, but the bases of most remain, and the whole ground is covered with the ruins of the columns that have fallen. Their height varied from 60 feet (including capital and base) in the front division, to 67 ft. 4 in. in the centre one. In these columns there is an advance upon the architecture of Egypt, for they have bases richly carved, and capitals of a form unknown to our art, before or since. The typical form is that of the double-headed bull with a deep cavity between the heads, evidently intended to hold a beam. There is a quaint grandeur about these columns, from their design and their gigantic size. The capitals of one division, the western, are 7 feet high, and 12 ft. 2 in. wide, whilst the shafts, 54 ft. 10 in. high, are each composed of only four great marble blocks. Unfortunately we have only fragments of these buildings, with no history or tradition to guide us as to their perfect forms. There are no walls, no doorways, and no roofs.

To sum up as to our knowledge of Persian art, the greater part of the remains are columnar, not an edifice is built on the Assyrian plan, and there is little to remind us of Assyria except the human headed bull. The doors and windows somewhat resemble those of Egypt. They have the same plain architrave, the large roll, cavetto, and fillet at top. But the sides of the portals are straight; there are no massive pylons, and the whole character of the columns, bases, and capitals is utterly unlike any known remains of Egyptian or Assyrian art. All we know is that Persian art was developed contemporaneously with that of Greece, though with utterly different results. The elegant form of the Greek temples, the curve of the Assyrian arch, would seem to have been unknown to the Persians, who, it appears likely, worked out their latest forms by gradual stages, from the early structures of wood, and thus originated a style, grand, picturesque, and in its ruins beautiful, but well-nigh isolated in the history of art, there being nothing from which it was quite copied, and nothing which seems quite to have sprung from it.

ARCHITECTURE OF ASIA MINOR.

Little was known of the antiquities of Asia Minor until, in 1838 and 1840, Sir C. Fellows discovered in its northwestern corner eleven ruined and deserted cities. It was reasonable to think that in these we should have the missing link between Assyrian and Greek art. But although a few of the sculptures show traces of Assyrian influence, and though the later structures are very similar to those of Greece, the productions of native art seem quite isolated and peculiar. The most ancient remains are considerably later than such masterpieces of skill as the tomb of Agamemnon at Mycenæ, and the great works of later times were erected long after the Parthenon.

The earliest works remaining are singularly like the Etruscan graves so often found in Italy. Perhaps the first of these is the tomb at Tantalais near Smyrna, which has simply a square chamber, ceiled with a pointed arch, formed with oversailing courses, and all covered with a tumulus. Like to it is the tomb of Alyattes, king of Lydia, on the bank of the Hermus, near Sardis. It has also one chamber, 11 feet by 8, and 7 feet high, in the centre of a circular pyramid, not sloping directly from the ground, as in Egypt, but having a high moulded stereobate, at the starting, some $\frac{3}{4}$ mile round. This structure would create no surprise if found in Tuscan; and still more to increase the resemblance to Etruscan work, it appears to have been surmounted by five stone pillars. Of the tombs which belong to the races between the above and the time when Greek art was introduced or was invented, the rudest are, perhaps, to be found in Caira. They are sarcophagi, and those

Olinda, e.g., are of enormous size, ranged on each side of the street leading to the city. In the simplest form a cavity was made in a great stone for the body, and a heavy lid put over it, coped or rising as a pediment in centre. Generally they were plain and oblong in shape. In Lycia, chiefly on the banks of the Xanthus, are found other sepulchres of remarkably singular form.

GRECIAN ARCHITECTURE.

Hitherto, we have found that, in each country, the artistic forms used in the earliest periods descended to later times, which embodied to some extent the traditional forms bequeathed to them. Even the Egyptian pyramids, unarchitectural as they are, were copied down to the 7th or 8th century in Nubia, and the earliest columnar architecture clearly shows itself as simply the beginning of a series of works extending from 2000 B.C. even to the Cæsars. But in Greece the earliest works are entirely separated from the later by an absolute break both in architectural forms and construction. In various parts of Greece and of Italy, specimens of rude walling are found of such remote antiquity that they are, as by common consent, referred to the fabulous ages, and, for want of a more distinctive term, are called Cyclopean. Now it appears, from the concurring evidence, in the opinion of most antiquaries, that a people who have been called Pelasgi, or sailors, migrated from Asia Minor, or the coast of Syria, at a very early period, and possessed themselves of various countries, some of which were unoccupied, and others inhabited by Celtic tribes. Their first arrival in the Peloponnesus was under Inachus, about 1800 B.C., and according to their own tradition they made their first appearance in this quarter as uncultivated savages. They must, however, at an early period have made some progress towards civilisation, since the most ancient states, Argos and Sicyon, owed their origin to them; and to them, perhaps with great probability, are attributed the remains of those most ancient monuments generally termed Cyclopeic. The most ancient specimen of Cyclopeic walling is found at Tiryns, near Mycenæ. It is composed of huge masses of rock roughly hewn and piled up together, with the interstices at the angles filled up by small stones, but without mortar or cement of any kind. The next species is in stones of various sizes also, shaped polygonally, and fitted with nicety one to another, but not laid in courses.

The oldest existing structure in Greece of regular form is of far superior construction to the Cyclopean walling, and must be referred to early colonists. It is at Mycenæ, and consists of two subterranean chambers, one much larger than the other. The outer and larger one is circular, and is entered by a huge doorway at the end of a long avenue of colossal walls, built in nearly parallel courses of rectangular stones, roughly hewn, however, and laid without mortar. Its external effect is that of an excavation, though the structure of the front is evident; and internally it assumes the form of an immense lime-kiln; its vertical section being of a conical form, with nearly parabolic curves, like a pointed arch. The construction of this edifice was thought to afford clear evidence that the Greeks were acquainted with the properties of the arch; but in the most material point this was destroyed on finding that it consisted of parallel projecting courses of stone in horizontal layers, in the manner called by our workmen battering, or perhaps more correctly, corbelling. It proves, however, that its architect understood the principle of the arch in its horizontal position; for it was discovered, by excavations above it, that the diminishing rings of which the dome is composed were complete in themselves for withstanding outward pressure; the joints of the stones being partly wrought radiating, and partly rendered so by

wedges of small stones driven tightly into them behind. The apex is formed, not by a key-stone, for the construction does not admit of that, but by a covering stone, which is merely laid on the course immediately below it.

As no nation has ever equalled the Egyptians in the extent and magnitude of their architectural monuments, neither have the Greeks been surpassed in the exquisite beauty of form and proportion, in the extreme simplicity and perfect harmony, which pervade every part of their structures. Unfortunately these monuments are known to us only by their ruins, for there is not a Grecian building remaining in a perfect state. In Greece proper, at least, this was not so until a comparatively recent date, viz., that of the war between the Venetians and Turks. The Parthenon itself was nearly perfect until that time, when it was shattered by an explosion of gunpowder (1687).

First in importance in Grecian architecture is the use of the three orders, Doric, Ionic, and Corinthian, with the peculiar mouldings, &c., connected with each. The Doric and Ionic columns, rudely drawn, appear on the early Etruscan or Greek vases. They are very slender, with large projecting capitals and with entablatures, which indicate pretty clearly copies from a construction of wood.

Of the triglyph, the most distinguishing part of the Doric entablature, there are many indications in the early works of Upper Egypt; and in the structures of the Ptolemies they are still more evident, though it may be objected that in them the indications were borrowed from the Greeks after the Macedonian conquest. But it must be borne in mind that the Egyptian nation did not change its character, religion, or usages by the change of its governors; and the Egyptians were, through the whole period of their existence as a nation, an originating and not an imitative people; whereas the Greeks seized on a beauty wherever they found one, and made it their own by improving it. To the question, why the Greeks cannot be allowed to have originated that beautiful style of architecture which they brought to the perfection it displays in their works, it may be sufficient to answer, that it would be against the common course of events if it were so. It is remarkable that, in Greece, the earliest specimen of columnar architecture that presents itself displays the chief characteristics which are found in works of periods when learning and civilisation were at their acme in that country.

Vitruvius gives several accounts of the origin of the Greek Doric order. He states first that "Dorus (the son of Hellenus and of the nymph Orseis), king of Achaia and of all the Peloponnesus, having formerly built a temple to Juno in the ancient city of Argos, this temple was found by chance to be in that manner which we call Doric." In another place he deduces the arrangements of the order from those of a primitive log hut, settling with the utmost precision what, in the latter, suggested the various parts in the former. But he also tells us that the Doric column was modelled by the Grecian colonists in Asia Minor in the proportions of a human figure, and was made six diameters in height, because a man was found to be 6 times the length of his foot. But this story, even supposing it to be rational, does not coincide with the Greek Doric at all, but, if with anything, with the Roman.

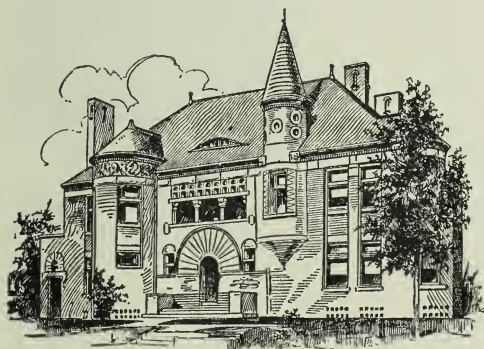
In the Greek examples, this order may be divided into three parts, stylobate, column, and entablature. The stylobate is from two-thirds to a whole diameter of the column in height, in three equal courses, which recede gradually the one above from the one below it, and on the floor or upper step the column rests. That



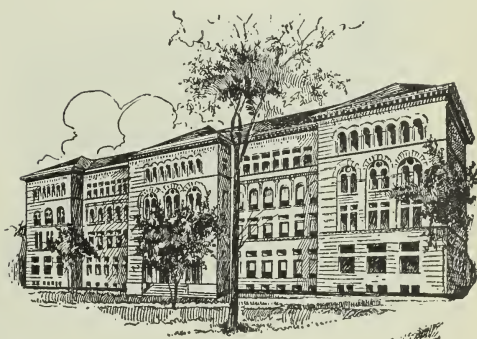
RESIDENCE ON PORTLAND PLACE
St. Louis, 1894



RESIDENCE ON PORTLAND PLACE
St. Louis, 1894.



RESIDENCE
St. Joseph, Mo. 1892



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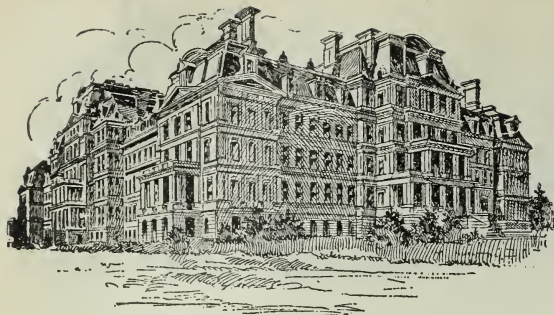


HOTEL WALDORF
NEW YORK. 1892

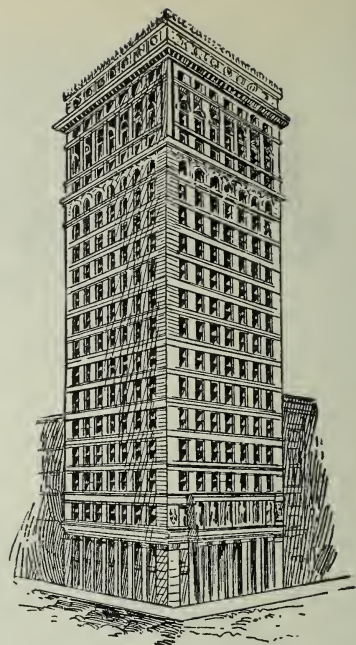


BY J. W. ROOT, DEC'D

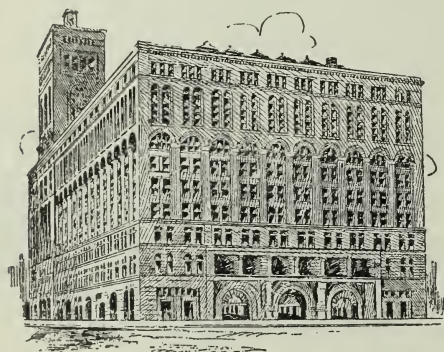
THE ROOKERY
CHICAGO, 1886



STATE, WAR AND NAVY DEPARTMENT BUILDING
WASHINGTON, D. C.



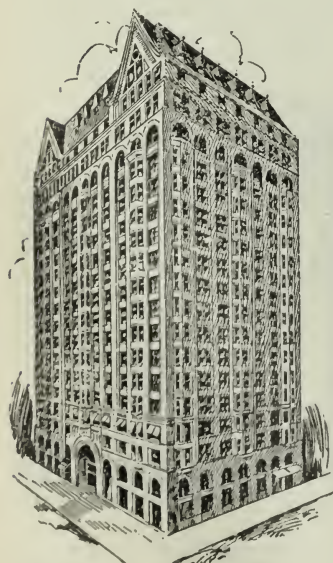
AMERICAN SURETY CO'S OFFICE BUILDING
NEW YORK CITY, 1892



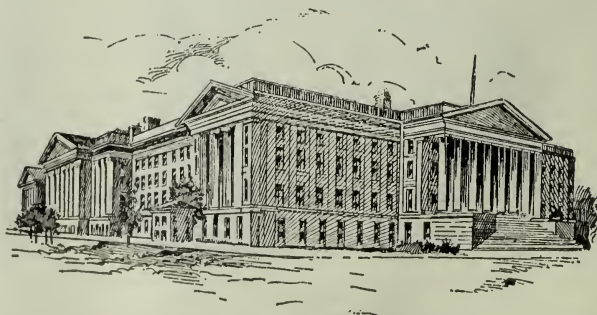
AUDITORIUM BUILDING AS SEEN FROM LAKE FRONT PARK
CHICAGO, 1888



HOTEL PONCE DE LEON
ST. AUGUSTINE, FLA., 1886



MASONIC TEMPLE OFFICE BUILDING
CHICAGO, 1890



THE TREASURY BUILDING
WASHINGTON, D C

graduation, it may be remarked, does not appear to have been made by the ancients to facilitate the access to the floor of the stoa or portico, but on the principle of the spreading footings of a wall, to give both real and apparent firmness to the structure, both of which it does in an eminent degree.

The column varies in height in different examples, from four diameters, as at Corinth, to six diameters, as at Sunium. Of this the capital, including the necking, is rather less than half a diameter: in those cases in which a necking does not exist, the capital itself occupies nearly the same proportion. The shaft diminishes in a slightly curved line, called an entasis, from its base or inferior diameter upwards to the hypotrachelium, where the diameter is from two-thirds to four-fifths of that at the base. It is the inferior diameter that is always intended when the term is used as a measure of proportion. The capital consists of a necking, an echinus or ovolo, and an abacus; the necking is about one-fifth of the height of the capital, and the other two members equally divide the remaining four-fifths; when there is no necking, the ovolo occupies the greater proportion of the whole height. The abacus is a square tablet, whose sides are rather more than the inferior diameter of the column. The corbelling of the ovolo adapts it to both the diminished head of the shaft and the extended abacus, flowing into the one, and forming a bed for the other by means of a graceful cyma-reversa; but its lower part is encircled by three or four rings or annulets, which are variously formed in different examples, and which give the echinus form to the great moulding, although it is, as we have said, part of a cyma-reversa. The shaft is divided generally into twenty flutes; but there are several examples with sixteen, and there is one with twenty-four. The flutes are sometimes segments of circles, sometimes semi-ellipses, and sometimes eccentric curves. They always meet in an arris or edge, and follow the entasis and diminution of the column up through the hypotrachelium to the annulets, under which they finish, sometimes with a straight and sometimes with a curved head. At the base they detail on the pavement or floor of the stylobate. In one example at Segesta the columns are not fluted at all, and in two others, at Cnidus and Delos, the flutes are marked at top and bottom only, but in these examples the columns were possibly not finished.

The third part of the order, the entablature, ranges in various examples from one diameter and three-quarters to rather more than two diameters in height, of which about four-fifths is nearly equally divided between the architrave and frieze, while the cornice occupies the remaining one-fifth; this is in some cases exactly the distribution of the entablature. The architrave is in one broad face, four-fifths, and sometimes five-sixths of its whole height; and the remaining fifth or sixth is given to a projecting continuous fillet called the *tænia*, which occupies one-half the space, and a regula or small lintel attached to it, in lengths equal to the breadth of the triglyphs above in the frieze. From the regula six small cylindrical drops, called *guttæ*, depend. There are examples to the contrary, but it may be taken as a general rule, that the architrave is not in the same vertical line with the upper face of the shaft, or its circumferential line, at the superior diameter, but is projected nearly so much as to impend the line or face of the column at the base. In one example only is the architrave known to be sculptured, viz., as Assos, where it has bas-reliefs of bulls fighting. The frieze, vertically, is plain about six-sevenths of its whole height, and is bounded above by a fascia, slightly projecting from it, which occupies the remaining seventh. Horizontally, however, it is divided into triglyphs and

metopes, which regulate the intercolumniations; the former being nearly a semidiameter in width, and the latter (the space interposed between two triglyphs) generally an exact square, its breadth being equal to the whole height of the frieze, including the fascia. This latter breaks round the triglyphs horizontally, and is little increased in depth on them. The metopes are shown on the vases to be holes between the ends of beams, and that the metopes were, at one time, open, seems to be proved by a passage in Euripides, who lived during the construction of the Parthenon. No example, however, early or late, remains to support this view. Each glyph, of which there are two whole ones and two halves to every tablet, is one-fifth of the width of the whole, and the interglyphs are each one-seventh of the whole tablet or triglyph. The glyphs detail on the *tænia* of the architrave, but are variously finished above. In some examples they are nearly square-headed, with the angles rounded off; in others the heads are regular curves, from a flat segment to a semi-eclipse. The semiglyphs are finished above in a manner peculiar to themselves, with a turn or drop; but hardly two examples correspond in that particular. The tablets in which the glyphs are cut are vertical to the face of the architrave, the metopes recede from them like sunk panels; these are often charged with sculptures, and indeed almost appear contrived to receive them. The third and crowning part of the entablature, the cornice, in what may be considered the best examples, projects from the face of the triglyphs and architrave about its own height. Vertically, it is divided into four equal parts, one of which is given to a square projecting fillet at the top, with a small congeries of mouldings, different, and differently proportioned to each other, in various examples. Two other parts are given to the corona, and the remaining fourth to a narrow sunk face below it, with the mutules and their *guttæ*. These latter form the soffit or plancier of the cornice, which is not horizontal or at right angles to the vertical face of the entablature generally, but is cut up inwards at an angle of about 80° . The width of the mutules themselves is regulated by that of the triglyphs over which they are placed, to which it is exactly equal. They are ornamented each with three rows of six small cylinders, similar to those which depend from the regula under the triglyphs and on the architrave. There is twice the number of mutules that there is of triglyphs, one of the former being placed over every metope also in the manner the examples indicate.

This completes the Greek Doric order according to the generally received sense of the term; but there are other parts necessary to it. In the front or on the ends of a temple, or over a portico, a pediment is placed. Its intention is to enclose the ends of the roof, but it forms no less a part of the architectural composition. In reason, it should be raised as much as the roof required; but when the span is great that would be unsightly; and reference appears to have been made to the common standard of proportion, as the pediments of most Doric temples are found to be about one diameter and a half in height at the apex of the tympanum, which in a hexastyle arrangement makes an angle at the base of about 14° , and in an octastyle about $12\frac{1}{2}^{\circ}$. The pediment is covered by the cornice, without its mutules, rising from the point of its crowning fillet, so that no part of it is repeated in profile. Another moulding, however, is superimposed: sometimes this is an ovolo with a fillet over it, and sometimes a cymatium. It varies much in its proportion to the cornice, but in the best examples it is about one-half the depth of the latter without its mutules. Ornaments of various kinds, statues or foliage, are believed to have been placed on the apices and at the feet of

pediments as acroteria. Of these, however, we have the remains of one only (a very beautiful one), viz., at Ægina; but indications of the plinths or blocks which may have received them exist, and such things appear represented on ancient coins and medallions. The tympana of pediments are well known as receptacles of ornamental sculpture. On the flank of a Doric temple, the cornice supported a row of ornamental tiles called *antefixæ*. These formed a rich and appropriate ornament, but they rather belonged to the roof than to the columnar arrangement or order. The *antefixæ* covered the ends of the joint-tiles as the pediments did those of the roofs; and corresponding ornaments called *stelai* rose out of the apices of the joint-tiles, forming a highly enriched ridge.

As before stated, the earliest examples of columns are the heaviest; they are also the most tapering, and there are some other details which help us in identifying the date of a Doric edifice in Greece proper. The hypotrachelium in early examples, as at Corinth, has three grooves; in later, as the Parthenon, only one. The contour also of the chief member, the echinus, varied at different dates. In the earliest it was full and round, as at Corinth, and at Assos (the latter having the greatest curve of any known example); sometimes, possibly, as at Segesta, struck with the compass, but almost always part of a conic section (parabola). In later times it became less curved, and in the finest examples almost flat, as in the Propylæum and Parthenon, but still forming part of a very delicate curve (hyperbola). In one case, at Selinus, where, to an inexperienced eye, the whole temple would appear to be of the same date, the differences alluded to contrast very strongly with each other. In the very late times of Greek work, when art became debased, the coarse round form of earlier work is exhibited, as in the Agora. The width of the abacus in early examples, as Corinth, is as much as two-sevenths the height of the shaft and cap. In later examples it diminishes to one-fifth. And as the column, so the entablature was more massive in the early examples, except in the colonies, where the old proportions continued to a late period. At Pæstum the proportion of entablature to column is as 1 to 2.4; Ægina, 1 to 2.53; Theseum, 1 to 3 nearly.

The Grecian Ionic.

Of this beautiful and graceful order it is as difficult to determine the origin as of the Doric. The explanation of Vitruvius is that the Ionian colonists, on building a temple to Diana, wished to find some new matter that was beautiful. Following the method which they had pursued with the Doric (proportioning the column according to the dimensions of a man), they imparted to this the delicacy of the female figure—in the first place, by making the diameter of the column one-eighth of its height, then by putting a base to it in twisted cords, like the sandals of a woman, and forming the capital with volutes, like the hair which hangs on both sides of her face.

From the recent discoveries in Assyria, however, there can be no reasonable doubt that the Greek colonists of Ionia at least obtained their idea of the Ionic capital from Nineveh. As to its earliest forms great differences of opinion exist. An extremely plausible theory, originated and ably worked out by Mr. Skidmore, suggests that the delicate Ionic curls were copied from the curved ornamental wire-work of the goldsmiths.

Of this graceful and elegant style we take the proportions and peculiarities from the perfect examples of the Athenian Acropolis. This order may also be considered in three similar parts, stylobate, column, and

entablature. The stylobate is in three receding equal courses or steps, whose united height is from four-fifths to one diameter. The column, consisting of base, shaft, and capital, is rather more than nine diameters in height; of which the base is two-fifths of a diameter, and the capital, including the hypotrachelium, is in one case three-fourths, and in the other seven-eighths of a diameter high. As shown in the vases, it is invariably very long and slender, and without bases; but no actual example remains to us without a base. The base consists of a congeries of mouldings extending gradually from a diameter and a third to a diameter and a half, and its height is in three nearly equal parts, two equal fillets separating them. The lowest, a torus, rests on the top of the stylobate or floor of the portico, a fillet divides that from the scotia, a second fillet intervenes between the scotia and a second torus, and a third fillet bases the apophyge or escape of the shaft. The upper torus of the base is, in one example, fillet-fluted horizontally; and in the other, the same member is enriched with the guillochos. The shaft diminishes with entasis from its lower or whole diameter to above five-sixths of it immediately under the hypotrachelium. It is fluted with twenty-four flutes and alternating fillets, which follow the diminution and entasis of the column. The flutes in plan are nearly semi-ellipses, and they finish at both ends with the same curve; a fillet is in thickness nearly one-fourth the width of a flute. The difference in the height of the capital is in the length of the necking, which in one case is separated from the head of the shaft by a carved bead, and in the other by a plain fillet. Above the necking, a height of about one-third of a diameter is occupied by a congeries of three spreading or corbelling mouldings—a bead, an ovolo, and a torus—which are all appropriately carved. On these rests the parallelogramic block, on whose faces are the volutes, and whose ends are concaved into what is technically termed a bolster to connect them. This part is about one-third of a diameter in height, and includes a rectilinear abacus, whose edges are moulded to an ovolo and carved with the egg and tongue ornament. The volutes are three-fifths of a diameter in depth, and extend in front to one diameter and a half; and they are nearly a semi-diameter apart. The bolsters are fluted vertically with alternate fillets, on which are carved beads. An ornament composed of the honeysuckle with tendrils encircles the necking of the column. It must be remarked, that as the capitals are parallelogramic, and present two similar fronts, to preserve the appearance of volutes externally on all sides, the capitals of the columns at the external angles of porticoes are differently arranged. The outer volute is bent out at an angle of 45° , and volutes are put on the end or side-front of the capital also, the outer one being the other side of the angular volute of the front. To suit the angle internally, the two volutes of the inner face are placed at right angles to each other: this is, however, at best but an awkward expedient, and need not be employed when a portico projects only one intercolumniation. All the Greek volutes are flat on the surface, except at Bassæ, where the volutes are curved.

The entablature, which is rather more than two diameters in height, is also divided into three parts,—architrave, frieze, and cornice,—which may be proportioned by dividing the whole height into five parts, four of which, as in the Doric, may be again equally divided between the architrave and the frieze. The cornice, however, in the example referred to, does not occupy one-fifth of the entablature; but if it had a fillet over the upper moulding, which it appears to want, that would be just its proportion. If the architrave be divided into

nine parts, seven of them may be given to three equal fascias, which slightly project the one before the other; the first or lowest, which is vertical to the circumferential line of the inferior diameter, being covered by the second, and the second by the third. The remaining two-ninths form a band of mouldings corbelling a broad fillet, which separates the architrave from the frieze; these mouldings are enriched. The frieze, which does not project quite so much as the lowest fascia of the architrave is, in the Athenian examples, quite plain; but it may be enriched with foliage, or made the receptacle of sculpture in low relief. In two examples (one at Selinus, and another at Agrigentum), the frieze has the Doric triglyph. The cornice projects from the face of the frieze rather more than as much as its whole height, and is composed of bed mouldings, a corona, and crown-mouldings. The first are a carved bead and carved cyma-reversa, the former of which only occupies a portion of the height of the cornice, as the planeer is cut up inwards, to a sufficient depth for it; the crown mouldings, which consist of a carved ovolo above a carved bead, are rather more than one-fourth of the whole cornice; and the corona occupies the rest of its height, except that small portion given to the bead of the bed-mould. A fillet above the crown-mouldings, as already intimated, is certainly necessary to complete the order and receive the antefixæ, as has been heretofore in this article described in the Doric, for the flank of a temple.

The pediments in the examples of Ionic are flatter than in those of the Doric, the angle made by the covering cornice with the base being, in a hexastyle, less than 14° . A vertical fillet, with a small moulding, equal in depth to the two crown-mouldings of the cornice, covers them in the pediment, in the place of the cyma-recta or ovolo used in the Doric order. The intercolumniation differs in these examples; in the one it is two diameters, and in the other three diameters and one-sixth.

A much greater variety is found in the composition of the Ionic than the Doric order. Indeed, the examples of the Athenian Acropolis alone have neckings. In all the others the shaft runs up to the corbelled mouldings which bed the block of the volutes, and the flutes finish under them. Neither have they a torus in that congeries, but a bead and ovolo alone, the latter projecting inconveniently under the pendent lines that connect the volutes, and thus the capital is not more than half a diameter in height.

The Asiatic or the truly Ionian examples of this order are far inferior to those above referred to. Their bases are differently, and certainly less elegantly composed. They are without hypotrachelia, as may have been inferred; they want the torus in the capital; and, in most cases, instead of flowing, pendent lines, they have straight lines connecting the volutes. Their entablatures are not so finely proportioned, nor so delicately executed. The coronas want breadth, and the bed-moulds of the cornice are as much too heavy as those of Athens are perhaps too light. Indeed, upon the whole, they have more of the grossness of Roman architecture than of the delicacy and elegance of Grecian, though the Ionian examples are supposed to be the models of those of Athens. In the celebrated temple of Diana at Ephesus the columns present an almost unique example of the lower parts being sculptured.

The width of the antæ of the Ionic order is determined, as in the Doric, by the soffit of the entablature; and it will, of course, be exactly the same as, or rather less than, the inferior diameter of the column. It is slightly raised, too, from the face of the wall at the ends of which it stands. The base of the antæ is, in one

of the two examples of the Acropolis, a little deeper than that of the column, having a small projecting moulding between the lower torus and the floor; the lower torus itself is reeded. In the other example there is no difference in the form and proportion of the antæ and columnar bases, but both the tori are fluted horizontally, with beaded fillets between the flutes. The antæ cap consists of a congeries of corbelling mouldings, nearly one-third of a diameter in height. It is divided into three nearly equal parts, the lowest of which is composed of a bead and an ovolo; the second of another bead and a cyma-reversa, all carved; and the third of a plain flat cavetto, with a narrow fillet and small crowning cyma-reversa, forming an abacus. The necking is like that of the capital, and is enriched in the same manner. The cap or cornice thus formed breaks round the projection of the antæ, and is continued along the wall under the entablature the whole length of the building, or till it is impeded by some other construction; and the base is continued in like manner. Attached columns have the voluted capital, but their base is that of the antæ; and it is detailed round them and along the wall to which they belong as with the antæ. It must be remembered, however, that the attached columns in the triple temple are about one-ninth less in diameter than those which are insulated, though they are similar in other respects, and have the same entablature.

The Grecian Corinthian.

The traditinary tale Vitruvius relates regarding the invention of the Corinthian capital (about Callimachus and the basket on the grave of the Corinthian virgin), is the only reason for the name it bears. With much more reason might the Doric be called the Corinthian order; for, as previously stated, the oldest existing example of that style is at Corinth; whereas there is nothing, either in ruins or authentic records, to prove that the latter was ever known in that city. Columns with foliated capitals are not of a very early date in Greece; earlier examples exist in Asia Minor, and foliage adorns the capitals of columns in some of the Pharaonic monuments of Egypt. In the Assyrian sculptures, however, the Corinthian capital is clearly shown. The interior of the temple of Apollo Didymæus, at Miletus in Ionia, exhibits the earliest example of the acanthus leaf arranged round the drum of a capital in a single row, surmounted by the favorite honeysuckle; but that edifice was constructed about a century before Callimachus is understood to have lived. The only perfect columnar example in Greece itself of this species of foliated capital is of later date than, and is a great improvement on, that of Miletus; it is the beautiful little structure called the choragic monument of Lysicrates at Athens.

The Caryatides, or Caryatic Order.

Besides the three species of columnar arrangement enumerated above, the Greeks employed another in which statues of women occupied the place of columns. The use of representations of human and other figures, with or instead of columns, is common in Egypt and India; and to the former the Greeks were doubtless indebted for the idea, though they appear to have restricted its application to human female figures.

Of these there is but one existing example. It is the third portion of the triple temple in the Athenian Acropolis, and is a projection from the flank of the principal Ionic structure, formed by a stereobatic dado raised on the stylobate and antæ-base mouldings, with a sur-base consisting of a carved bead and carved ovolo covered by a broad listel, with a narrow projecting fillet above it. On this rests a square plinth, supporting a draped female figure, on the head of which there is imposed a circular moulded block, with a deep rectangular abacus, two-

thirds of whose face is vertical, and the other third is a cavetto fillet, and small cyma-reversa. The stereobate, including the moulded base of the temple, is about three-fourths the height of the statue pillar with its base and capital. The entablature is rather less than two-fifths of the same, but it consists of architrave and cornice alone, between which parts the height is nearly equally divided.

Of Grecian Mouldings and Ornaments.

Greek architecture is distinguished for nothing more than for the grace and beauty of its mouldings; and it may be remarked of them generally that they are eccentric, and not regular curves. They must be drawn, for they cannot be described or struck; so that, though they may be called circular, or elliptical, it is seldom that they are really so, and if they are, it is evidently the result of chance, and not of design. Hence all attempts to give rules for striking mouldings are worse than useless; the hand alone, directed by good taste, can adapt them to their purpose, and give them the spirit and feeling which render them effective and pleasing.

The leading outline of Greek moulding is the gracefully flowing cyma. This will, indeed, be found to enter into the composition of almost everything that diverges from a right line; and even combinations of mouldings are frequently made with this tendency. It is concave above and convex below, or the reverse; and though a long and but slightly flected line appears to connect two quickly-curving ends, it will always be found that the convexity and the concavity are in exactly the same curve, so that if the moulded surface were reversed, and the one made to assume the place, it would also have the appearance, of the other, and the effect would be the same. It is, in fact, the Hogarthian line of beauty; and it is not a little singular that Hogarth, in his well-known *Analysis of Beauty*, although he did not know, and indeed could not have known, the contours of Greek architectural mouldings, has given the principle of them, and, under his line of beauty, has described many of the finest Greek forms. The Roman and Italian mouldings were called Greek in his day, and he assumed them to be so; but they evidently do not agree with his theory, whereas, in principle, the now well-known Greek forms do most completely.

It may be inferred from some existing edifices, particularly the choragic monuments, that the Doric columnar style was not used by the Greeks, except for temples of the gods and some of their accessories. But whether this arose—if the feeling really did exist—from the sanctity of its character, in consequence of that appropriation, or from the difficulty of moulding it to general purposes, cannot be determined. It is very certain, however, that the few structures which do exist of Greek origin, not of a religious character, are either Ionic or Corinthian, or a mixture of one of them with some of the features of the Doric; and in all Greece and the Grecian colonies, except Ionia, there are very few examples of religious edifices not of the Doric order, and none which are of the Corinthian.

The only pure Greek architectural works besides temples that remain to us, and of which we have certain information, are propylæum, or propylæa, choragic monuments, and theatres. The propylæa, as applied to the Acropolis of Athens, is the entrance or gateway through the wall of the peribolus. It consists of a Doric hexapstyle portico internally, with a very singular arrangement of its columns, the central intercolumniation being ditriglyph. This was done, probably, to allow a certain procession to pass, which would have been in-

commoded by a narrower space. Within the portico there is a deep recess, similar to the pronaos in a temple, but without columns *in antis*; a wall pierced with five doorways, corresponding to the intercolumniations of the portico, close to the entrance; and beyond it is a vestibule, divided into three parts by two rows of three Ionic columns, and forming an outer portico, fronted externally by a hexapstyle exactly similar to that on the outside. Right and left of it, and setting out about one intercolumniation of the portico from its end columns, at right angles, are two small triastyle porticoes *in antis*, with chambers behind them. These have been called temples, but most probably they were nothing more than porters' lodges or guard-houses. The whole structure, though extremely elegant and possessing many beauties, is not a good architectural composition; the unequal intercolumniation detracts from its simplicity and harmony.

TOMBS.—These, the grandest structures next to the temples in Egypt, present little worthy of notice in Greece proper; but in the colonies there are several of considerable importance. The grandest are in Caria and Lycia, to some of which, constructed much after the ancient outlines of the Lycian, &c., reference has already been made. The most singular of the pure Greek tombs are cut in the face of the solid rock, not in the forms of the ancient rock-cut tombs, but much resembling those of the temple.

Of all the Greek tombs the grandest was that of Mausolus, at Halicarnassus, in Caria, one of the seven wonders of the ancient world, which has given its name to all succeeding great tombs. Its date is about 352 B.C., Mausolus having died in 353. It was erect until the 10th century. Since then it has been so utterly ruined that there was doubt as to its actual site. This was indicated by Professor Donaldson; and in 1857, Mr. Newton discovered the actual remains. "It consisted of a lofty basement, on which stood an oblong Ionic edifice surrounded by thirty-six Ionic columns, and surmounted by a pyramid of twenty-four steps. The whole structure, 140 feet in height, was crowned by a chariot group in white marble, on which, probably, stood Mausolus himself" (Newton). The size of the basement was 114 feet by 92. The name of the architect was Pythius, and the sculpture, with which the edifice was richly adorned, was executed by four celebrated sculptors, of whom we may especially particularize Scopas, as he was also the architect of the celebrated temple of Tegea.

THEATRES.—The Greek theatre deserves a short notice. It was entirely different from ours, having neither pit, boxes, nor roof, except the usual velarium, as a protection from the sun. Its plan was somewhat more than a semicircle, having seats cut out of the side of some hill convenient for the purpose. Round the top was a colonnade, and at the back of the stage was the scena. This and the colonnade combined in an artistic way, must have formed a very effective composition. At first the theatres were of wood; the first of stone, at Athens, having been built, it is said, about the middle of the 4th century. The theatres at Argos and Ephesus were 450 and 600 feet in diameter respectively, whereas Covent Garden Theatre, London, including the corridors, is only 100 feet.

HOUSES, &c.—No remains exist of the domestic structures of the Greeks. It may be taken for granted that the houses were less extensive than those of the Romans, as they were a poorer and less luxurious people; but the exquisite beauty of form and decoration, which pervades every article of Greek origin, whether coin, medallion, vase, implement of war or husbandry, or even the meanest article of domestic or personal use,

is evidence of the fine taste with which their mansions must have been furnished.

FORTIFICATIONS.—We have large remains of fortifications in Lycia, though few in Greece proper. They are not so picturesque as the mediæval, nor, we may say, as the Assyrian. They were massively built of masonry, with square towers at intervals, furnished sometimes with a pediment, sometimes with battlements. The doors and windows on the upper floor are still found at Alinda, in Caria. The Greek shield was often sculptured as hung on the walls. A bas-relief from Pinara, in Lycia, gives a complete sketch of the walls, with circular-topped battlements, a postern gate, and various openings, all square-headed; and a door is shown, panelled like our doors.

In the construction of their edifices the Greeks seldom, if ever, had recourse to foreign materials—the stone used in their temples being almost invariably from the nearest convenient quarries which supplied it of sufficiently good quality. The structures of Athens are built of marble, from the quarries of Pentelicus, and those of Agrigentum, of a fossil conglomerate which the place itself furnished.

RÉSUMÉ.—Taking now a rapid view of what we owe to the Greeks as architects, we may assume that the invention of columnar architecture is due to the Assyrians; but how far this had advanced before the Greeks began to practise it, we cannot as yet exactly determine. There is no doubt, however, that it owed to the Greeks the greater part of its beautiful and delicate details. Some of the finest examples of these are to be found at Athens in the Theseum, Parthenon, Propylæa, and Erechtheum, ranging in date from 469 to 409 B.C. Not only do we find there the most beautiful mouldings and other ornaments, but the most refined methods of obviating the minute defects in outline supposed to be caused by optical illusion. The lines of the shafts, for instance, in place of being perfectly straight, were slightly expanded between the base and necking, so as to form a very delicate curve (entasis). The apparent depression of the top of the cornice, supposed to be caused by the extra weight in the centre of the pediment, was obviated by curving the cornice so that the centre part was the highest. The steps were curved in a similar way. Then the whole of the columns of the peristyle sloped towards the centre. The architrave and frieze in the Parthenon followed the same slope of about 1 in 80, but its boldly overhanging cornice and antæxæ sloped forwards about 1 in 100.

We owe also to the Greeks one new form in art—the pediment. It is not found in Egypt; some slight suggestions as to its use may, perhaps, be found in the sculptures of Assyria, but in Greece it forms the crowning feature of every temple; and simple as the invention may seem, it led the way to a succession of others, which resulted in the grand gables of our Gothic architecture.

The details of the Grecian temples were heightened by color and gold. Of the former, Dr. Faraday detected many traces on the sculptures of the British Museum; and clear indications of it have been found in many of the ruins both in Greece proper and in the colonies. In fact, color, or tinting of some kind, seems to have been absolutely requisite in order to relieve the monotonous and dazzling effect of new white marble. A striking example of this occurred recently when the palace of the king was built at Athens. The newly-worked marble had much the appearance of a smooth stucco or brilliant whitewash. But this would serve (and doubtless did serve in ancient times) as an admirably delicate base for decorative work in color and gold.

What the effect was of a Greek temple, in all its

glory, we can no more judge than we can in the case of one of ancient Egypt. For there is not one that is not a mere wreck; and even the most ambitious of modern copies, the Walhalla, wants the exquisitely delicate material out of which the Parthenon was wrought, and the sculpture which no modern Phidias was living to supply. But in Greece proper there was but this one type, viz., that of the pedimented temple with its colonnade. There was no arch, as in Assyria, to span an opening too wide for a stone beam; no dome to vary the outline by its bold and graceful form; no curved outline, as at Mycenæ, to vary that of the rectangle.

The form adopted by the Greeks was worked out in a manner which leaves all others of ancient art, wrought in the same likeness, far behind; and the details which adorned that form charm the eye with their exquisitely chaste beauty. But in our admiration of them we must not forget that numerous other forms, beautiful in themselves, and familiar in their beauty to the Assyrians and Pelasgi, as they are to us, were unknown to, or neglected by, the Greeks.

ETRUSCAN ARCHITECTURE.

Little of the history of Etruria is as yet known, for accounts of Roman historians are not to be relied on, and the Etruscan language is as yet unread. Our acquaintance with its architecture, too, is very meagre, for the comparatively few remains show us simply the forms used by the Etruscans in their tombs; and even these have been as yet imperfectly explored, owing to the nature of the climate, and the desolation of those parts of the country in which they are chiefly found. The sites of the Etruscan towns are nearly all on or near a line, curving slightly from the sea, extending from Fiesole, near Florence, through Arretium, Cortona, Volsinii, and Falerii, to Rome. The only sites of much importance near the sea were Cosa and Tarquinii. The towns were generally planted on the tops of high hills, as if for the purpose of defence. Much of the town-walling remains in various places, as at Fiesole, Cortona, Cosa, and Volterra, and furnishes grand examples both of the polygonal and of the squared masonry, which has been described as belonging to the early period of Greek architecture.

The tombs were of two classes, the first being nearly of the same external form as that described at Tantalais, viz., with a massive stereobate, circular in plan, having one or more chambers in the center of it, and above it a tumulus of earth. Of these, hundreds of specimens of various sizes remain. At Volci there was one 240 feet in diameter. The grandest of all is, perhaps, that at Cervetri, drawn by Canina, and known as the Regolini Galeassi.

One of the best examples, though a very late (Roman) date, is a tomb of Cervetri. The chamber was supported on two pillars. In each side of it were recesses, 2 feet in height, each having a bed, with cushion for the head, tassels, &c., all sculptured and painted. The sides and pillars were decorated with painting and sculpture, representing the helmets, shields, swords, and other accoutrements of the officer whose tomb it was. But there were also depicted in the same way the personal ornaments of his wife, her mirrors, jewelry, &c. Her slippers are marked on the floor, and by the side of the recess near, is carved her husband's walking-stick. Even the kitchen utensils appear in effigy, so as to give the whole fittings of the house of a Roman officer.

Of Etruscan temples no remains exist, and the accounts of them are so conflicting that any restoration of them must be very uncertain.

ROMAN ARCHITECTURE.

We have taken it for granted that the Greeks were ignorant or neglectful of the properties of the arch. If the great sewer at Rome, called the Cloaca Maxima, belongs to the time of Tarquinius Priscus, it must be conceded that the properties of the arch were known, and the arch constructed in that city. But it is contended that the Cloaca Maxima, as it now exists, is a work of much more recent date, and that it may have succeeded the sewer constructed by the first Tarquinius, who was, moreover, himself a Greek. It is, however, now certain that the construction of the arch was known to the Egyptians, and used by them at a very early date, although, for some reason which we do not quite understand, they neglected it in their greatest works. That it was known to and made great use of by the Assyrians is also certain. Whoever it was that invented it, and at whatever date, the Romans made extensive practical use of it, and by its means they succeeded in doing what their predecessors in civilisation had never effected. It enabled them to carry secure and permanent roads across wide and rapid rivers, and to make a comparatively fragile material, such as brick, more extensively used than the finest marble was in the hands of the Greeks. To the Greeks, however, the Romans were indebted for their knowledge of the more polished forms of columnar architecture. Before the conquest of Greece the structures of Rome appear to have been rude and inelegant, and from that time the existing style of architecture either gave place to the superior merit and beauty of what the Romans found in that country, or was combined with it, though frequently the combination tended to destroy the beauty of both.

Much of the extent and magnificence of the architectural works of the Romans is attributable to their knowledge and use of the arch, which enabled them to utilise inferior materials. Almost all their structures were of brick—aqueducts, palaces, villas, baths and temples. Of the present remains, only a few columns and their entablatures are of marble or granite, and two or three buildings are of Travertine stone,—all the rest are brick. The colosseum, the mausoleum of Adrian, the tunnel sewer, the temple of Fortuni Virilis, and the ancient bridges on the Tiber, are of Travertine stone; the remaining columns of the more splendid temples, the internal columns and their accessories, of the Pantheon, the exterior of the imperial arches, and the cenotaph columns of Trajan and of Antonine, are of marble; but the Imperial Mount of the Palatine, which holds the ruins of the palace of the Cæsars, is one mass of brick; the Pantheon, except its portico and internal columns, &c., is of brick; the temples of Peace, of Venus and Rome, and of Minerva Medica are of brick; and so, for the most part, were the walls of others though they may have been faced with marble or freestone. The baths of Titus of Caracalla, and Diocletian, are of brick; the city walls are of brick; so are the extensive remains of the splendid villa of Adrian, and those of the villa of Mæcenas at Tivoli; the palaces of the Roman emperors and patricians at Baie and in other parts of Italy; and so, it may be said, are the remains of Herculaneum and Pompeii, for the houses in these cities are generally built of alternate double courses of brick and courses of stone or lava. In most cases, at Rome and in the provinces, stucco formed the surface which received the decorations. From the above enumeration, it will appear how much more variously the Romans built than any of their predecessors. In Egypt we find no indications of edifices of real utility or convenience, nothing but temples and tombs,—and in Greece there is but a small addition to this list; but in Rome are found specimens of most

every variety of structure that men in civilized communities require.

Particular Roman Structures.

TEMPLES.—Whatever forms were adopted from the Greeks by the Romans were rapidly altered by the latter. The temples, for example, were, no doubt, constructed, in the main, after the Greek model. But we find three-quarter columns used in the flanks, as at the temple of Fortuna Virilis at Rome and at Nismes, in place of the open peristyle or plain flat wall. These three-quarter columns were, it is true, used at the rear of the Erechtheum and at the temple of the Giants at Agrigentum. But these were quite exceptions. Then, in the portico of the Pantheon the Romans availed themselves of the properties of the arch to effect an immense change in the internal design and appearance.

From the forest of columns, as at the Parthenon, all placed at equal distances, or nearly so, the Romans boldly removed four rows, arched over the space thus left, and so obtained a picturesque effect quite unknown to the Greeks.

THEATRES.—The best remaining specimens of Roman theatres are those of Pompeii and Herculaneum. Like those of the Greeks, they rest on the side of a hill, but instead of being hewn out of the hill they are built on it. Others in a more or less ruined state remain in Italy, France, Sicily, &c., *e. g.*, at Rome, Verona, Pola, Taormina, and Arles. At first they were of wood, and one by Æmilius Scaurus, 58 B. C., is said to have held 80,000 spectators. That they were copied mainly from the Greeks there can be no doubt. In fact, one built by Pompey is expressly stated to have been copied from another at Mytilene, and their general form is very similar to that of the Greek theatre. But the Roman theatre received a greater degree of architectural decoration than the Greek. Of this the theatre of Marcellus, in Rome, is an example; for though otherwise destroyed, its external wall remains and presents columnar ordinances, with intervening arches in stories, according to the practice of the Roman school.

AMPHITHEATRES.—These are altogether Roman in general design. The first is said to have been built by Julius Cæsar, and others were afterwards built by Caligula and Nero. The first of stone is said to have been the Colosseum, built by Vespasian and Titus, and so called from the Colossus of Nero which stood near. It was injured and then restored under Severus and Decius, in whose time it is probable that the upper row was added. As to the awning, we know that the main portion at least of the audience was protected from the fierce rays of the sun by a strong velarium. This was supported on the outside by heavy masts, which passed through holes still existing in the top cornice, and stepped down on the corbels, which show so conspicuously in the top order. Recent excavations have disclosed the original arena, about 20 feet below the present level of the ground. Evidence has also been obtained that the arena was sometimes a movable platform. To obtain an approximate idea of the size of this enormous structure, we must remember that the Albert Hall (the largest diameter of which is 276 feet) could have been placed in the arena alone of the Colosseum, the exterior of which measures 622 feet by 528. Other amphitheatres of great size were constructed in the various towns of the empire. Amongst them we may mention that at Verona, 500 feet by 404, and Nismes (still used for public shows), 434 by 340. Extensive remains of another, 376 feet by 220, have been discovered recently at El-Djemm, in Tunis. (See AMPHITHEATRE, vol. i., pp. 295-296.)

TOMBS.—Some very grand examples of tombs of cir-

cular forms remain, as well as many others of great beauty. It must be remembered that with the Romans both burial and cremation were used. The columbaria (vaults lined with small recesses for the urns, which contained the ashes of the dead) present the most ordinary specimens of architectural forms adapted to cremation. The sarcophagus, of which that of the Scipios is the best known example, presents the ordinary form used in connection with burial. But when the family of the deceased was rich or distinguished, the ashes or the sarcophagi were enclosed in buildings of the most magnificent kind. The tomb of Cecilia Metella, so well known to all by Byron's beautiful lines in *Childe Harold*, commencing—

"There is a stern round tower of other days,"

is a bold tower 90 feet in diameter and 62 feet high, so solidly built as to contain only a chamber 19 feet in diameter. Much grander was the mausoleum of Augustus, which has perished. Of the mausoleum of Hadrian the skeleton only remains. But it shows that the base was 170 feet square, supporting a circular edifice 115 feet in diameter. It would seem that this mass, now formed into the castle of St. Angelo, and showing the naked brickwork, had, in its glory, two ranges of marble columns and probably a domed roof. From its position on the banks of the Tiber, near the bridge, it must have formed one of the grandest architectural compositions of the Romans.

FORUMS.—At first these great buildings were used for merchants, and were open spaces with porticoes, shops, counting-houses, &c., all round. The best example existing is, perhaps, that of the Forum of Pompeii. In later times these erections expanded into grand architectural ranges of porticoes, with statues, &c. Leading out of them, in various positions, were temples, law courts, theatres, &c. It was in Trajan's Forum that his famous column was erected.

The **AQUEDUCTS** show little of the skill of the architect, but they are very picturesque as they stretch along the Campagna and other places. Across a valley, at Tarragona, one rises to a height of 100 feet, and another, the Pont du Gard, at Nîmes, to 180. But they do not reach the level of true architectural beauty, and derive their chief value from their immense length and size.

The **TRIUMPHAL ARCH** is peculiarly Roman, and it is in this form that the arch appears to have been most boldly used as an external feature. The arch is, in fact, the form to which all other parts of the structure are mere decorative adjuncts. The principal examples are the arches of Titus, Severus, Janus, and Constantine at Rome, and that of Trajan at Ancona.

DWELLINGS.—The still extensive remains of the villa of Hadrian, near Tivoli, bespeak its original magnificence. Everything appears to have been directed to internal splendor and effect alone; and, indeed, all collateral evidence tends to the conclusion, that the exterior of Roman palaces and mansions was not heeded, being merely plain brick walls. This is the case at Pompeii, and the ruins of mansions in various parts of Italy, and from that of Sallust on the Benacus or Lago di Garda, to those of other Roman nobles on the shores of the Bay of Baïæ, present no indications whatever that their exteriors were subjected to architectural decoration. The palace of Diocletian at Spalatro, and the splendid remains of Baalbec and Palmyra, some of which, perhaps belonged to secular structures, offer evidence to the contrary of this, if they are correctly restored in the works which treat of them. Notwithstanding the extent of the structure and its general magnificence, however, the mouldings and ornaments in the interior of the villa of Hadrian, though in them-

selves classical and elegant, are small, and have a general air of littleness, especially when compared with the apartments to which they belong,—not that the apartments are generally large, but they are for the most part lofty. The ceilings appear to have been formed by vaulting; there are no indications of windows, and none of stairs of any magnitude—so that the rooms must have been nearly, if not quite, open at one end to admit light and air; and the probability is that there were seldom apartments above the ground floor, though it is likely enough that terraces formed on the vaulted roofs were used for the purposes of recreation and pleasure. Of the floors, which were of mosaic, several are preserved entire in the museum of the Vatican; where also are deposited many fine specimens of ornamental sculpture in vases and candelabra, besides busts, statues, and groups in bronze, marble, porphyry, and granite, of various styles, remains of the noble collection Hadrian made during his progress through his extensive dominions, which have been found among the ruins of the villa.

In Pompeii we may see the domestic as well as public architecture of ancient Rome, although it must be remembered that Pompeii was a Greek colony, and that it was destroyed as early as 79 A.D. We have, therefore, probably to expect more Greek character than would be met with elsewhere.

The streets of Pompeii are very narrow, their average width being not more than 12 or 15 feet; frequently they are not more than 8 feet wide, and very few in any part exceed 20. The principal excavated street in the city, that leading from the Forum to the gate towards Herculaneum, and the street of the tombs, is, at the widest, 23 feet 6 inches, including two footways, each 5 feet wide. The streets are all paved with lava, and almost all have side pavements or footways, which, however, are for the most part so narrow, that, with few exceptions, two persons cannot pass on them. That the cars or carriages of the inhabitants could not pass each other in most of the streets, is proved by the wheel-ruts which have been worn on the stones, and the recesses made here and there for the purpose of passing. They are lined on both sides with small cells, which served for shops of various kinds; and they are strikingly like the ordinary shops in towns in the South of Italy and in Sicily at the present time. They resemble these, too, in this respect, that there appear in very few cases to be accommodations in connection with the shops for the occupiers and their families, who must have lived elsewhere, as modern Italian shopkeepers very commonly do. They present no architectural decoration whatever; the fronts are merely plain stuccoed brick walls, with a large square opening in each, part of which is the door, and part the window, for lighting the place and showing the goods.

RÉSUMÉ.—Roman architecture, as we know it, dates only from about the Christian era, and the rapidity with which it spread from that time is something marvellous. Through nearly the whole extent of the Roman empire, through Italy, Asia Minor, Sicily, Britain, France, Syria, Africa,—with one great exception, Egypt,—all was Roman in mouldings, ornaments, details, the very style of carving and the construction. No matter what the country or the architect, all seem to have lost their nationality when the Roman came, and to have adopted implicitly his system of design and decoration. It has been seen that he copied the orders and much of the leading forms of his buildings from the Greeks. But he speedily added others. The apse and the circle on plan were his; so were the dome and the arch in elevation; and thus he enlarged at once the whole range of the architect's powers, and whilst utterly disregarding the delicate refinements of the Greeks, secured a freedom of

design which resulted at length in our Pointed architecture.

But great as the advance was, it seems to have been arrested just when opportunities were offered, on the grandest scale, for bringing about the noblest results. The Roman architect seems to have been unable to reach the highest effort of art, viz., to bring the whole of any grand edifice into one splendid mass, to concentrate the detailed parts into one grand whole. But in reflecting on what the Roman did *not* do, we must not forget that we owe to him some of the grandest forms to which we too are now accustomed.

We now come to a complete change in the structures which we have to describe. Henceforth we shall find no Forum, no public bath, theatre, temple, or house. All these forms disappear, and for nearly 700 years, until the time when the Norman castle arose, well-nigh every building of architectural merit was in some way or other ecclesiastical. But with our Christian faith there arose forms of beauty utterly unknown to the Pagan, which culminated in the glories of Lincoln and Canterbury.

POINTED ARCHITECTURE.

In those countries which received the Christian religion from Rome, but which did not contain such mines of architectural material in temples, amphitheatres, and palaces, as Italy did, and, indeed, in the remotest parts of Italy itself, which did not contain them as Rome did, churches were constructed in imitation of those of the metropolis of the Christian world. These being the work of a semibarbarous and unpolished people, were of necessity comparatively rude, and from them arose the Gothic architecture of the Middle Ages,—not from any previously existing style of architecture among the northern nations who overran Italy and subverted the Roman power, the rude Celtic monuments being the only specimens of architecture they possessed. The transitional style of architecture referred to will be found in what are called the Saxon and Norman buildings of England, and to a greater or less extent in all parts of Europe in which the Romans had been masters, and particularly in those which adhered to the Roman communion in the great division of the churches. The general forms and modes of arrangement peculiar to Roman architecture may be traced throughout; in some specimens they are more and in others less obvious, but the leading features are the same. This is more evident in Italy than elsewhere. In the early Roman basilicas and churches, some of which are of the age of Constantine, and which were constructed in the Roman style, the first divergencies occur; in those which are later they are still greater, and distance of time and place appears still to have increased them, till what may be called a new style was formed, having peculiarities of its own, but even more clearly deducible from its origin than Roman is from Greek or Greek from Egyptian. The variation in the development from the parent stock is great, but in all cases there is more or less evidence of the descent. It must be noted, however, that there was one important modification of Roman art, and this was the Roman art modified by contact with the East, and known commonly as Byzantine. Its influence was felt first and most strongly in St. Mark's, Venice, a building which is entirely Byzantine in style as opposed to Romanesque. From Venice it was copied in Périgueux in the church of St. Front, and this copy influenced the style of a vast number of buildings in the south-west of France. St. Mark's, again, had a great influence on the Lombard works of Northern Italy, and these were the originals from which Germany, by way of the valley of the Rhine, derived all its mediæval buildings. To the greater part

of France and to England the stream of art was much more purely Romanesque, being the result of knowledge of genuine Roman art, with little, if any influence from the East. In Spain we see the direct influence of the Romans, the direct influence of the Arab, and the indirect Byzantine influence of the south-west of France, all materially affecting the development of the national architecture. As might be expected, this style was not the same in all the countries which practised it; it was derived, in them all, from the same source, as we have shown, but was materially influenced by the habits, manners, and state of civilisation of the various nations, and much, too, by their means of communication with Rome. This, in strictness, may be called Gothic architecture, as it was partly induced by the Gothic invasions of Italy, and was invariably practised by the nations to whom that term may with propriety be applied. It arose in the 4th century, and was subverted in the 12th by the invention or introduction of the pointed arch, which marks a new area, and was destined to give birth to a new style in architecture.

Where, when, and with whom the pointed form originated has been more discussed and disputed than the discovery of properties of the arch itself. The pointed arch, on its introduction into Europe, was not accompanied by any of its ordinary accessories in after-time,—its light clustered pillars, its mullions, foliations or featherings, and graceful tracery. These developments resulted from its adoption; so that whether the arch itself was invented in Europe or imported from the East, to the European nations must be assigned the credit of developing the beautiful style of architecture whose distinguishing feature it is.

There have been only too many arguments and discussions on the name which is most appropriate to the style. By common consent the word Gothic is used all over Europe to designate it, and it now hardly matters whether or not there was originally good reason for the use of such a term.

Pointed architecture took root and grew with almost equal vigor, though under different conditions, in almost every part of Europe. But the honor of having developed the style to the very highest perfection must undoubtedly be adjudged to France, or rather to the small portion of the country, including Paris, which formed the old Ile de France. In Germany there was much less natural development. For a long period after the Lombard style had been perfected on the Rhine no variation of moment was adopted, until German architects attempted at Cologne to outvie and rival the magnificence of Amiens. In Spain the architects of some of the finest buildings were Frenchmen, and the style can hardly be said to have been developed there at all. In England, on the contrary, though the earliest Pointed buildings were undoubtedly to a great extent French in their origin, the developments of the art were soon entirely national, and were but little modified even by the influence of the foreign religious orders, which (as at Fountains Abbey) had so much power over many of our ecclesiastical foundations. From England the style was carried by Englishmen to Scotland,—a poor country, with no style of its own, and no cultivation such as is necessary to produce an order of architects, and to Ireland, where the English architects followed the footsteps of the invading armies; and finally, if we may trust the evidence of the stones themselves, to the coast of Norway, where the cathedral of Trondhjem is as unmistakably English in much of its style and detail as any English cathedral. In England the development of the style is plainly marked, and its advances are easily traceable. We find in various portions of the same edifice, according to the period of its construction, exem-

plifications of the style, from the ingrafting of the simple lancet arch on the Norman piers in the time of Henry II., to the highly enriched groinings and ramified traceries of the age of Henry VII.; but the changes are so gradual, and are so finely blended, that the one in advance appears naturally to result from that which comes before it.

English Gothic Architecture.

The history of the development of Gothic architecture is, perhaps, more easily read on the buildings themselves in England than it is in any other part of Europe. The Roman buildings in England were never of very great importance, and were not always standing as evidences of the existence of an older style, which might be looked back and up to with respect and admiration, even where they did not harmonise with popular customs. Such art, nevertheless, as did exist, in that country before the eleventh century, was, no doubt, derived from Roman examples existing in the country, and copied in a rude and unskillful fashion by native workmen. The existing Roman remains show that there was quite enough architectural and decorative art introduced into the country by the Romans to have formed a school of masons, sculptors, and builders, if the civilization of the people had been sufficient to make them desire it. Such a school can hardly be said to have been formed if one looks at the few and comparatively rude remains of buildings certainly erected before the Norman Conquest. In such work as the beautiful archway recently discovered in Britford church, Wilts, where carving of stone-work is joined with brick or tile and stone in a very elegant fashion, is seen the immediate effect of cultured Roman influence and example. At a later date, in such fine works as the steeple of Earl's Barton, Northants, we see only the rude grandeur of comparatively uncivilised workmen cognizant only at a distance of good Roman work. In upwards of a hundred churches, dispersed in various parts of England, fragments more or less complete of these early buildings, erected before the Norman Conquest, still remain. They are numerous enough to enable us to classify their features in a general way, and they agree in certain definite points of difference from the architecture which prevailed after the Norman Conquest. It is probable that a considerable proportion of these buildings were erected after the year 1000, when we recollect the influence which the expected end of the world had in discouraging building shortly before that date, and how enormous the zeal for building was as soon as it was safely passed.

The transition from the simplest Early Pointed to a more advanced style can be seen as well in Westminster Abbey as anywhere. There traceries began to take the place of simple lancet openings, and led to that system of window tracery which was, in fact, the distinguishing feature of the succeeding style. When the invention of tracery was complete, everything in Gothic architecture rapidly changed. The art of masonry and stone-cutting was rapidly developed. Moulded stones, from being made continuous round the intricate combinations of window traceries, came naturally to be used much more largely than before in place of simple bearing shafts. So columns came to be formed of clusters of mouldings; and, in the case of groined buildings, each moulding of the shaft was developed into more mouldings above the capital, or even frequently carried on to the vault without any capital at all. Traceries were first of all commenced by merely piercing geometrical patterns or circles through the thickness of the walls. Then these patterns were combined under one enclosing arch; and then, when this sort of tracery had reached perfection,

it was found possible to vary it indefinitely by making use of double curves (or ogee lines); and then, when these had been used for a short time, flowing lines, wandering gracefully over the space to be filled, and sometimes drawn by hand, supplanted the more formal outlines of the earlier work. The difference was great between an opening which was made (as the earlier examples were) with a sole view to the opening for glass, and one which was the accidental result only of the pretty lines and curves made by regarding the monial of the window, and not the light, as the thing to be considered. The tendency of the modification was to make men think lines of more importance than masses; and, whether consciously or not, this was just what happened: not only window traceries but mouldings, carvings, and every other feature, were entirely changed in character. The soft gradations of the early mouldings were given up for combinations of more hardly defined and thinner lines of light and shade, and, in harmony with this change, a crisp and sharp imitation of natural foliage was devised, which supplanted the rich and round forms of the earlier sculpture. The whole practice of art was becoming more scholarly, perhaps, but at the same time it was more conscious, and the cleverness of the architect was almost as often suggested as the noble character of his work. Merton College chapel, Oxford, the nave of York Minster, the choir of Selby, the whole of Exeter Cathedral, are a few among the many examples of this period of which England can boast, and it will be seen that the change in character which is evident between the earliest and latest Middle Pointed works is enough to justify those who would again subdivide the nomenclature. The difficulty is that, where progress was so constant, it will be necessary, in order to be exact, to subdivide each century five or more times in order to be really definite.

A few words will suffice for the necessary notice of the progress of Gothic architecture in Scotland and Ireland. In point of fact, most of what was done in the best period—that is, during the 13th and 14th centuries—was done by English artists, and is in no way more distinct in character than their work was in different dioceses or counties. The Gothic of Lincolnshire, of the eastern counties, of Kent and Sussex, of Somersetshire and South Wales, of Devon and Cornwall, and of Yorkshire, were distinct varieties of style and full of local peculiarities.

There is no country richer in examples of architecture than France. The student who wishes to understand what it was possible for a country to do in the way of creating monuments of its grandeur, would find in almost every part of the country, at every turn and in great profusion, works of the rarest interest and beauty. The 19th century may be the consummation of all, but the evidences of its existence to posterity will not be one-tenth in number of those which such a reign as that of Philip Augustus has left us, whilst none of them will come up to the high standard which in his time was invariably reached.

Gothic Architecture in Germany.

The German Complete Gothic is essentially national in its complete character. It has a similarity to English and French Middle Pointed, but no more than this. It has many and obvious defects. From the first there is conspicuous in it that love of lines, and that desire to play with geometrical figures, which in time degenerated into work more full of conceit and triviality than that of any school of mediæval artists. These conceits are worked out most elaborately in the traceries of windows and panelling. The finest early examples are in the cathedral at Minden; a little later, perhaps, the best

series is in the cloister of Constance Cathedral ; and of the latest description the examples are innumerable. But it is worth observing that they rarely at any time have any ogee lines. They are severely geometrical and regular in their form, and quite unlike our own late Middle Pointed, or the French Flamboyant. In sculpture the Germans did not shine. They, like the English, did not introduce it with profusion, though they were very prone to the representations of effigies of the deceased as monuments.

In one or two respects, however, Germany is still possessed of a wealth of mediæval examples, such as is hardly to be paralleled in Europe. The vast collection of brick buildings, for instance, is unequalled. If a line be drawn due east and west, and passing through Berlin, the whole of the plain lying to the north, and extending from Russia to Holland is destitute of stone, and the mediæval architects, who always availed themselves of the material which was most natural in the district, built all over this vast extent of country almost entirely in brick. The examples of their works in this humble material are not at all confined to ecclesiastical works; houses, castles, town-halls, town walls, and gateways, are so plentiful and so invariably picturesque and striking in their character, that it is impossible to pass a harsh verdict on the architects who left behind them such extraordinary examples of their skill and fertility of resource. Then, again, in regard to the furniture which before the period of the Renaissance of art and the Reformation of religion filled the ancient buildings, the Germans have more than any other people been happily conservative. There are still churches in Germany in which it may be said that nothing has been changed since Luther's day except the use of the buildings. St. Katharine's at Lübeck is turned into a museum, but is full of its old furniture. The choir of Halberstadt is unused, but everything, even to the hangings on the walls, remains as of old. In Nuremberg all the altars are preserved, and decked with altar-cloths and candles, though they are never used ; and when so much toleration as to these externals has been shown and so little desire for change exists, it may well be imagined that the opportunities for the study of works of German Gothic architects in their completeness are unusually plentiful. During the last few years a vast number of books have been published on the subject of their national antiquities by German writers, and the amount of detailed information on the subject, which may be obtained by those who care for the study, is unbounded.

Modern English Architecture.

When the Pointed style received its deathblow in England, in the reign of Henry VIII., it did not immediately cease to exist ; nor was it immediately succeeded by the Italian when it became extinct. It was gradually declining through all the 16th century, during the latter part of which period what has been called the Elizabethan style became somewhat permanent. It consists of a singular admixture of the Italian orders with many peculiarities of the Pointed style, and in many examples the latter appears predominant. With such difficulty, indeed, did that fascinating manner give up its hold on the minds of men in this country, that the Cinquecentists appear to have relinquished the hope of effecting its destruction, unfortunately, however, not until the injury was done ; and for some time England was left without a style at all, unless that may be called by the name which marks the edifices of the reign of James I., and of which the oldest parts of St. James's Palace are a specimen.

The destruction of the Pointed style has been referred by some to the change in religion which took

place under the Tudor line of English monarchs, but certainly without sufficient reason. It was the "Reformation" of architecture in Italy, and not that of religion in Great Britain, that effected it ; and it may be doubted whether the change would not have taken place sooner in that country if its connection with Italy had not been so materially affected by the moral change there ; for it was Germany and France that supplied it with architectural reformers during the reigns of Henry VIII. and his children, and not Italy, whose professors might possibly have obtained more credit than their disciples did.

It is an argument in proof of the classical beauty of the Pointed style, that when the eyes of men were opened to the perfections of Greek architecture, they began to discover its merits also. Pointed architecture, under the opprobrious name Gothic, had long been a subject of discussion among antiquaries,—that is, essays were written by them to prove how the pointed arch originated, but none appreciated its beauties. The Pointed cathedrals and churches were, after the example of Inigo Jones, ruthlessly barbarised in course of repairing and fitting them up. If an architect were employed to do anything about one of them, he appears to have thought it incumbent on him to convert it to the doctrines of his own faith—to Italianise it.

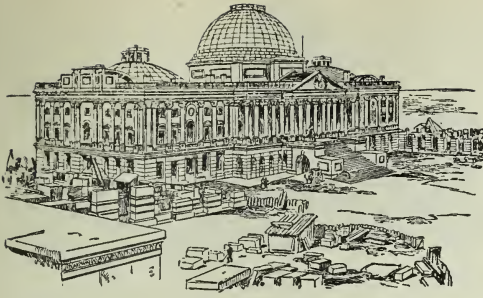
Saracenic Architecture.

The beautiful forms by which Saracenic or Arabian architecture is best known were wrought into a style, if they were not invented, by the descendants of the wild Arab tribes who accepted Mahomet as their leader and prophet. In estimating their influence upon architecture, the first point to be considered is whether the Arabs, as they emerged from their deserts and overran the rich countries of Syria, Persia, and Egypt, brought with them any art of their own, or whether they formed their style after their conquests were secured, when they had become great, and had consequently leisure and power to form it by the aid of foreigners. Now, in the Koran no notices are found that would lead one to suppose that any definite forms of art were known to the Arabs in early times. We gather also that the minaret, one the most prominent and beautiful forms of their architecture, could not have been used in early times, since we are told that the call to prayers was then made from the roofs of the mosques.

The earliest example of a mosque in Arabia itself is supposed to have been that at Mecca, 705 A.D. But this was rebuilt in the 15th century, and that of Medina in the 16th, and we have no definite account of the original structures. The earliest of those which still exist are the Mosque of Amrou at Cairo (about 642 A.D.), and that of Damascus (705). Both of these were built of columns, &c., obtained by the destruction of Roman work.

In the Mosque of Tooloon at Cairo we find for the first time anything original. It was constructed about 879, and is said to have been designed by a Christian architect. Indeed, numerous passages in the early history of the Saracens seem to show that their architects and art workers generally were foreigners, attracted from Baghdad, Byzantium, and other places. It was the same throughout their progress in Spain as well as in Egypt ; and however that style was eventually formed, which has given to us the beautiful domes and minarets of Cairo, the Alhambra in Spain, and the houses of Algiers, there can be little doubt but that it was based upon the art of Persia and Byzantium.

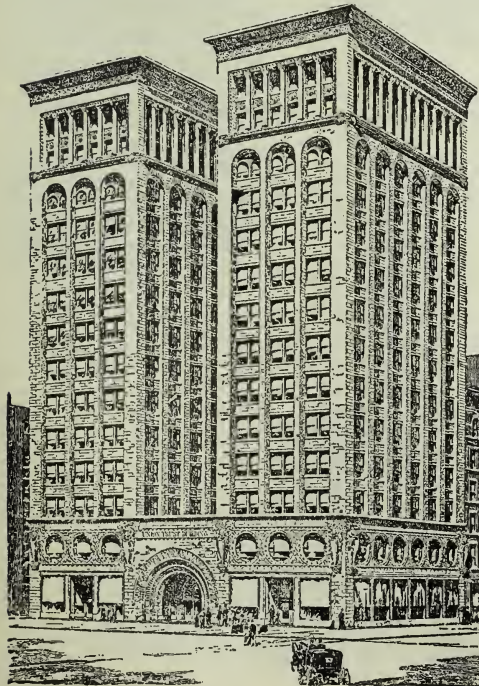
Ultimately it developed into two very distinct forms,—the Arabic of Cairo and the Moorish of Spain. But these still showed themselves, both in general form and



CAPITOL AT WASHINGTON, AS FINISHED BY BULLFINCH, FROM THORNTON'S AND LATROBE'S DESIGNS IN 1830, WITH COMMENCEMENT OF WINGS BY WALTER IN 1851



TRINITY CHURCH, BOSTON, BY THE LATE H. H. RICHARDSON, 1875



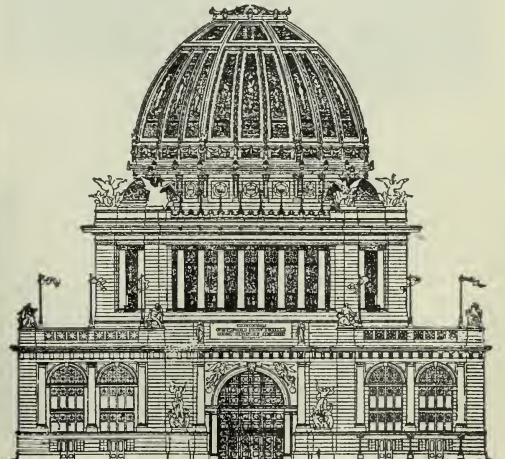
UNION TRUST COMPANY'S BUILDING, St. LOUIS, MO., 1892, BY LOUIS J. SULLIVAN—STEEL SKELETON CONSTRUCTION



EXCHANGE BUILDING, KANSAS CITY, 1886, BY J. W. ROOT, DEC'D



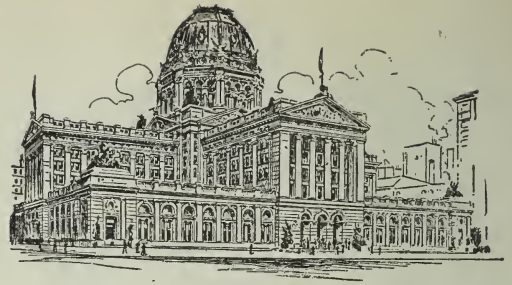
MILLS BUILDING, SAN FRANCISCO, 1891, BY J. W. ROOT, DEC'D—STEEL SKELETON CONSTRUCTION



ELEVATION OF ADMINISTRATION BUILDING, WORLD'S COLUMBIAN EXPOSITION, CHICAGO, 1893, BY R. M. HUNT, DEC'D



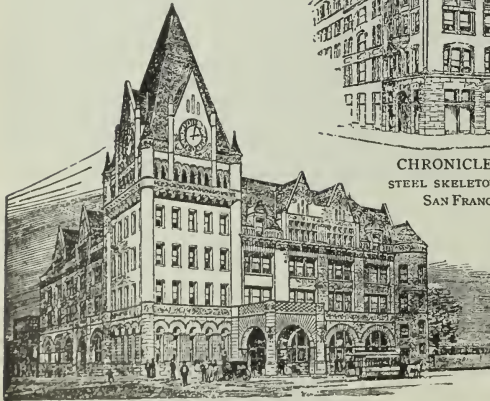
SCHILLER BUILDING
STEEL SKELETON CONSTRUCTION
CHICAGO, 1892



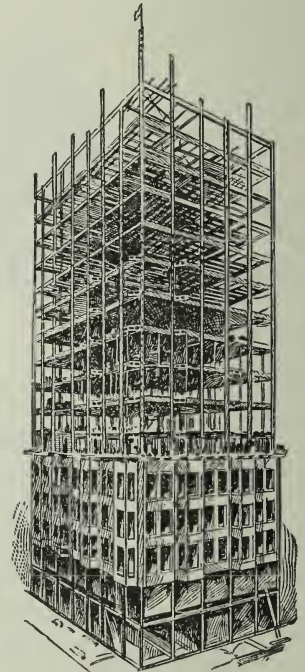
UNITED STATES CUSTOM HOUSE AND POSTOFFICE
CHICAGO, BY H. I. COBB, 1896



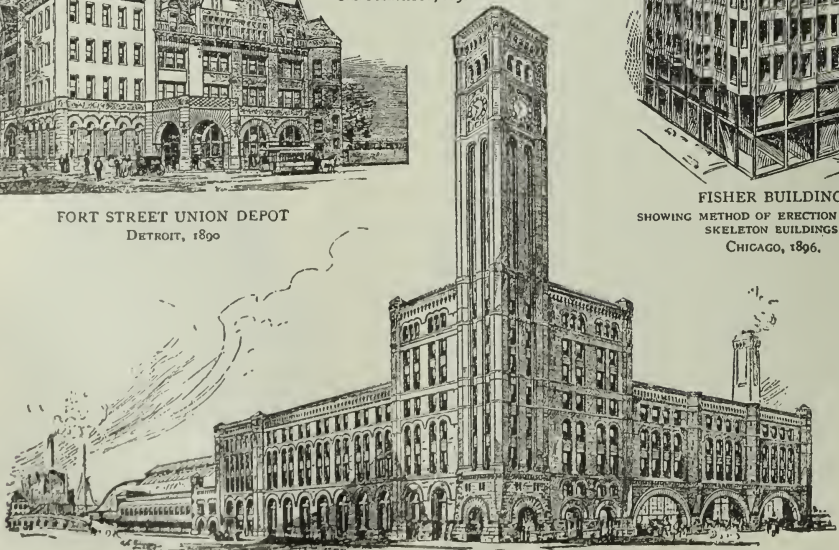
CHRONICLE BUILDING
STEEL SKELETON CONSTRUCTION
SAN FRANCISCO, 1890



FORT STREET UNION DEPOT
DETROIT, 1890



FISHER BUILDING
SHOWING METHOD OF ERECTION OF STEEL
SKELETON BUILDINGS
CHICAGO, 1896.



GRAND CENTRAL PASSENGER STATION
CHICAGO, 1889

in details, to be members of the same great family which we now call Saracenic. The chief structures in this style are the mosques and tombs. The former are very simple in plan, consisting, usually, of a mere open space with colonnades round and with a prayer niche (*mehrab*) in the side towards Mecca. Near this was a pulpit (*mimbar*), and as this part of the edifice was of course the most frequented, the colonnades were made of extra depth. In the centre of the court was a fountain, just as in the atrium of the Christian basilicas; and conspicuously, sometimes at each corner of the mosque, was placed a minaret. The size of the whole and the number and richness of the columns might vary, but the general arrangement was nearly always the same, the really essential parts being the prayer niche, the pulpit, the fountain, some protection against the burning noonday heat, and some elevated place from which the priest could call to prayers. A remarkable exception to the ordinary plan occurs in the celebrated Mosque Soultan Hassan at Cairo, which is in the form of a cross, and four arms being arched over, whilst the centre is left open and contains the usual fountain. Closely connected with the mosque is, often, the tomb of its founder. This is nearly always covered with a dome which, when on a large scale, was almost invariably a sign of a sepulchral edifice.

One of the ornaments peculiar to the Saracens, and constantly used by them, was the honey-comb by which they brought the square base, which they almost always used on plan, into the circular dome or niche-head. It was, in fact, the Saracenic pendentive. In its simplest form it occurs very early in the style, as *e.g.*, at the Mosque of Tootoon at Cairo, and was composed of a series of small niches, the pointed head of each of which bent forward at the top and formed the springing point of two others. The repetition of a few rows of this produced a pendentive in which it is impossible to detect any harsh point of junction between the square base and the circular finish. Sometimes this honey-comb work was exceedingly intricate, and form niche-heads, roofs, &c. Good examples of this occur at the Zisa, Palermo, and at the Alhambra.

Chinese Architecture.

The buildings of the Chinese are very inferior in character to those of India; in fact, Mr. Fergusson goes so far as to say, "China possesses scarcely anything worthy of the name of architecture." Sir W. Chambers has described one of the Buddhist temples, that at Ho-nang, which is not like those of India in arrangement. There is an extensive court with avenues of trees, leading to a flight of steps and portico of four columns. In a second vestibule behind this are four colossal figures bearing various emblems. Beyond this is a very large second court, entirely surrounded by colonnades and small sleeping cells for the priests or *bonzes*; in other words, a huge cloister, much like the Indian viharas. In the same ranges are four pavilions filled with idols, and large rooms for refectories, behind which are the kitchen, courts, &c. At the extreme corners of the grand court are four other pavilions, the dwellings of the higher order of priests. At equal distances behind each other, down the centre of the court, are three larger pavilions, called *tings*, entered on each side by a flight of steps, and a fourth engaged in the cloister itself, and having a portico and one flight of steps only. The first three are square, two stories in height, the lowest surrounded by fourteen columns, each face or front showing six. They have rude caps, composed of eight brackets, projecting various ways. Sir William Chambers says there are four species of *tings*,—three used for temples and the fourth for gardens; some having a gallery and fretted railing round the first floor on the out-

side, the upper story being set back. The roofs all have the peculiar hollow dip, which leads one to suppose their prototype was the tent, the sag of the cloth of which would suggest the form. They are frequently surmounted with a sort of cresting and finial, and each angle is turned up sharply, and ornamented with a dragon. Sometimes the columns have a frieze perforated in the form of frets; sometimes the same is also under the eaves of the upper roof. Examples are also given of smaller octagonal *tings*, intended to cover the large vessels in which the Chinese burn gilt paper to their idols.

Mr. Simpson has given an interesting account of the temple of Heaven at Peking. It lies in an open space of about one mile square, surrounded by a triple enclosure. In this space were kept the animals destined for sacrifice. The temple proper consisted of several detached structures, the most sacred being to the south, and consisting of a raised platform approached by three terraces, and bearing simply an altar unscreened by any building and open to the sky. The northern structure was roofed but not enclosed. Four pillars supported the main roof, which was 99 feet high, and lower roofs round the higher one were upheld by 24 columns of less height, all richly sculptured and gilt.

The most striking buildings in China are, however, the tapering towers which they call *taas*, and our old writers pagodas. These are of brick covered with marble, or most generally with glazed tiles; and are built in stories, one over the other, from three, four or five, to as many as nine in number. Each story is reduced in width, and has a gallery round it. The roofs are hollow or sagging, like those formerly described. They project a great deal, the corners being turned up sharply. On these light bells are suspended, which make a constant ringing when the wind blows. The roofs are covered with glazed tiles of various colors, and the summit ornamented with a species of spire and finial. The most celebrated of these was that known as the porcelain tower at Nanking. It had nine stories, and was about 200 feet high, exclusive of the iron spire. At each angle was a bell, making seventy-two in all; and there were eight chains hanging from the top of the finial to the angles of the spire, and carrying nine bells each, or seventy-two more. This celebrated building was destroyed by the Taepings in 1853. The *taa* is not a pagoda or temple, but a memorial of some event or of some great personage. At Peking is one used as an observatory, and at Nanganfoo one was erected simply to bring good luck.

Buildings called *Toov Tang*, or halls of ancestors, are found in all considerable towns. These much resemble temples, but instead of idols, memorial tablets are placed in the niches to record the transactions and deeds of the "worthies" or celebrated inhabitants of the neighborhood.

The *Pai Loo*, or *Pai Fang*, is another common object in China. These are monumental memorials, though they have been mistaken for triumphal arches.

The tombs are as singular as the rest of the Chinese edifices. One of these tombs is at Nanking, but the chief are about 40 miles north of Peking. The entry is by a grand *Pai Loo* of five gateways in white marble, and then through several other gateways to a singular dromos, nearly a mile long, of 32 colossal figures (ranged in pairs), some human, others of camels, griffins, elephants, &c. Such a dromos exists also at Shanghai. The tombs, thirteen in number, are ranged round the base of a hill and extend for several miles. Each consists of an earthen mound about half a mile in circuit, having, at its base, a crenellated retaining wall 20 feet high. The mound has no entrance, nor any

indication of the exact place of burial. To the south of the tomb is a temple in an open court, about 1200 feet by 500. The plan is just the ordinary one of a palace, and the names, "The House of the living and the House of the dead," seem to show clearly that this resemblance was intended.

The Chinese method of construction is very peculiar. Their roofs are put up first, supported on wooden posts, which are removed as the permanent fabric is built. The walls of the grand edifices are of stone, but the ordinary material is brick, and the work is often executed with beautifully close joints. In palaces and temples the whole was often gorgeously colored with glazed tiles, or the bricks themselves were colored and glazed. A magnificent example of this is a temple near the summer palace at Peking, all of which is of bright majolica, except its marble base. As with all structures belonging to the emperor the color was yellow, it being a capital offence for any other person to use that color.

The Chinese never use square timber when they can get round trees of a suitable size, probably on account of the lightness, strength, and convenience of the bamboo. The roofs are of very peculiar construction, and all timbers are left visible. The windows are filled in with the lining of the oyster shell, which looks like talc, and is quite as transparent; and the main door is frequently a perfectly round aperture. The old buildings of the Chinese, like those of the Saracens, are fast going to decay, and the streets of even their grand capital, Peking, now exhibit immense ranges of ruined buildings.

Ancient American Architecture.

It was not long before the exhumation by Mr. Layard, in Central Asia, of the wonderful remains of fine art entombed in earthen mounds, that Mr. J. L. Stephens, when engaged on a mission from his government—that of the United States of North America—to some of the mutable states of Central America, heard of and tracked out in the forests of Yucatan the remains of a bygone time, exhibited in sculptural and architectural monuments of a coarse character, affording a strange counterpart to those which Mr. Layard describes as having existed in and about the valleys of the Tigris and Euphrates. The remains of fifty or sixty cities have been discovered, the most interesting being those of Chololu, Palenque, Uxmal, Tescuco, and Mitla. The chief structures were evidently temples (*Teocallis*), raised high above the surrounding buildings on grand basements, square on plan, and rising by huge steps to the summit, so as to have the general outline of a low truncated pyramid. One at Palenque is 280 feet square at the base, and about 60 feet high to the platform, on which stands the temple, the latter being oblong on plan, measuring about 76 feet by 25. It was a low building, with a roof formed by stone gradini, so as to be, in fact, a continuation of the pyramid.

Less artistic, but more vast and massive, are the structures in Peru, which have been as yet imperfectly explored. Referred by Mr. Prescott to the reigns of the Incas, they are now considered to have been the works of a far earlier race, of whom the Incas were the conquerors. The rudest of these early works are sepulchral, and much of the same kind as the cromlechs and stone-circles already referred to.

One circle at Sillustani is 90 feet diameter, another 150 feet, and they have a massive paved platform all round them outside, which is not found in similar remains in the Old World. The cromlechs are not covered merely by a flat stone, but are rudely domed over by overlapping stones.

A much more artistic class of tombs is built of stones in the form of a tower, but increasing in width towards

the top, and domed as above described. Most of them are round on plan, but some are square and two stories high, the upper being covered with overlapping stones cut to the arch shape. Many of these are of hard stone, beautifully fitted together, and the chambers are lined with a peculiar stucco still in good preservation.

Some other sepulchral remains are on a much grander scale, being immense mounds held up by huge retaining walls. One of these mounds is 108 feet high, and 276 yards by 75 at the top. None seem to have been as yet explored. Of the fortresses one of the grandest examples is at Cuzco, 760 feet above the level of that city. It has three lines of fortifications in terraces 1800 feet long, the lower terrace having a retaining wall now 25 feet high, the second (30 feet behind the first) 18 feet, and the third (18 feet behind the second) 14 feet high. The walls are of cyclopean masonry, accurately fitted, one stone being 27 feet by 14 by 12, and many are 15 by 12 by 10 feet. The plan shows considerable skill, as the walls are not straight, but built with recesses and re-entering angles, evidently for giving the garrison command of the ground close to the walls.

Modern Architecture.

This title is generally applied to the architecture which has been used by European nations since the time of the Renaissance. The Renaissance, as we have seen, was a revival of Roman architecture, the study of which naturally led to an acquaintance with its prototype, the architecture of Greece. The examination of Grecian buildings, and the revival of their style, was much encouraged in the eighteenth century. In the beginning of the nineteenth century, the habit of imitating ancient styles had been established, and began to be applied to Gothic architecture also, which speedily came to be generally adopted, especially for ecclesiastical edifices. This has been particularly the case in Great Britain, and amongst the Anglo-Saxon race wherever found—in America, India and Australia. All modern architecture is imitative, and it is doubtful whether a really new style is possible. At present Gothic is generally adopted for churches, and Renaissance for domestic buildings. The Houses of Parliament at Westminster are one great example of an attempt to apply Gothic to a secular building, and the Law Courts recently erected in London are another. In France, the birthplace of Gothic, it is little practiced, the French having adopted a special modification of the Renaissance, which is known as the "French style." Most of the great modern towns, such as Paris, Lyons, and Marseilles, have been largely rebuilt in this style. In Germany and Italy the purer classic examples have been more frequently followed; but in recent years there has been a strong tendency both in Germany and this country to follow the style of Renaissance as practiced in each country during the sixteenth and seventeenth centuries. The architecture of America follows very much the same course as that of Europe.

Of a far higher class than the private dwellings are many of the places of business recently erected in our great towns. In the new banks, exchanges, insurance offices, etc., many of our most noted architects have produced good results; and if we cannot congratulate ourselves upon much that is being done, we can, at least, say that the new work is an improvement upon the old. In no instance, perhaps, is the advance more to be noted than in the club-houses and great warehouses for storing the lighter class of goods. A facade having long lines of windows, in many stories, each story of considerable height, and with only one main entrance doorway, affords the materials, of course, for forming a massive and pleasing effect.

In the United States the architects of the public buildings appear to be of much the same feeling as were English architects some years ago. The churches are often Gothic, but the other great edifices are in the main Italian, such as the capitols of Ohio, New York (Albany), and Washington. The last is a building of great size and picturesque outline, depending for its chief effect on the lavish use of porticoes and colonnades, and is recognized as the most important structure of the kind in the country.

Some of the best specimens of architecture in America are the city hall and postoffice, New York City; Girard college, Philadelphia; postoffice, county court house, Auditorium, Rock Island depot, Board of Trade building, Chicago and North-Western depot, in Chicago; Four Courts and Exposition building, St. Louis; Illinois State capitol, at Springfield, and the various other State capitols. Probably the best specimen of Egyptian architecture in America is the Virginia Medical college at Richmond.

In Canada very much the same state of things exists as in the United States, the art in each being much the reflex of that in the old country.

The adoption of Greek, Roman, or Italian architectural details, little modified by climate and customs, is, in fact, to be noted in almost every country — any form of art peculiarly national being now abandoned in their favor; and if the houses in Paris were to be transported to Berlin or Cairo, they would simply agree with what has already been done in those cities. And if, further, the Bourse or the Pantheon at Paris, the Museum at Berlin, the Glyptothek at Munich, or the great church of St. Isaac at St. Petersburg, were to be severally changed to any of the other cities, it would be fairly in harmony with the modern works around it, though the nationality and language of the peoples in those cities are utterly distinct from each other. This abandonment of natural and peculiar styles is now producing another result quite foreign to anything known in art history before. From the earliest period known until the 17th century almost every nation had its own peculiar forms of art, and practised it (modified, perhaps, by the conditions of climate) in every part of the world which it colonised or conquered; and the result was the interesting remains of Roman art, clearly to be identified as such in Europe, Asia, and Africa; of Norman in France, England, Italy, and Sicily; and of Saracenic from Spain to India. This clear identification of a nation by its art works is as valuable to the historian as to the artist. But we can look for this no longer.

ARCHIVES (Lat. *archivum*), a room or building in which are kept the records, charters, and other papers belonging to any state, community, or family. Very frequently the name is applied to the documents themselves. The archives of the United States are now superintended by the heads of departments.

ARCHON, the title of the highest magistrates in Athens. The last king of Athens, Codrus, having given up his life for the advantage of the state, it is said that the people, out of gratitude for his noble act, passed a resolution that in future none of their rulers should bear the ancient and venerated title of king. The holder of supreme power in the state received from that time the name of archon or ruler. This is the popular account of the change, but it is not improbable that, on the death of Codrus, disputes arose with regard to the succession, and that the nobles took advantage of the opportunity to gain an addition to their power. In 684 a change was effected; the office was made annual, and the supreme power was distributed among nine officials, each of whom received the title of archon. To secure that the office and honors were not conferred on un-

worthy persons, the newly-elected archons were subjected to a double scrutiny, before the senate and in the agora, in which they were required to show that they were true Athenian citizens, whose ancestors had been citizens for three generations, and to swear that they would obey the laws and revere the religion of their country.

Of the nine archons to whom in conjunction were entrusted the duties of the supreme magistracy, the first was called specially "The Archon"; there was also attached to his name the epithet *eponymus*, because the year in which he held office was named after him, just as at Rome it was named after the two consuls. At first this archon had the general administration of state affairs, but gradually the expansion of democratic power reduced his authority, and at the period of which we have accurate information his duties were not very extensive. As a special department of civil administration, he had under his care all orphans, particularly heiresses, all widows, and others who were left without protection, provided they were citizens of Athens; and had, in short, the charge of all matters in which questions of inheritance were involved. The second archon had the title of king (*βασιλεύς*); to him had been handed over the name, as well as the sacred duties of priesthood which formerly belonged to the supreme ruler. He acted as public prosecutor in matters of religion; and, in cases of murder or offense against the gods, he brought the indictment into the Areopagus, and voted with its members. In later times he acted as president of the court in all cases concerning the rights and duties of priests. The third archon bore the title of polemarch, which indicates that originally he was the supreme commander of the Athenian forces. Doubtless the introduction of the ten generals by Clisthenes tended to limit the military functions of this archon. His duties in later times seem to have been the superintendence and protection of the personal and family rights of the resident aliens and foreigners. To these he stood in the same relation as the archon eponymus stood to citizens. He had also the arrangement of the funeral games in honor of those who had fallen in battle, and the offering up of the annual sacrifice to Artemis in commemoration of the battle of Marathon. Each of the three superior archons was allowed to select two assessors or assistants, who were sanctioned after examination by the senate. The remaining six archons were called thesmothetæ (*θεσμοθέται*), a name which is sometimes applied to the whole body of archons. The six formed a college of justice, whose jurisdiction seems at first to have extended to all cases not directly under the cognizance of other magistrates. They received information against parties for various offenses, brought the cases to trial in the proper court, appointed the juries, and gave public notice of the days of sitting. They revised every year the body of laws to see that no discrepancies were allowed to creep in, and they were required to enter all new laws. They also drew up and ratified the treaties with foreign states. After the introduction of popular courts by Solon, the archons seem to have lost their special juridical powers; they then acted simply as presidents of the court and sometimes as a grand jury. During their year of office the archons were exempt from all state burdens, and at its close they were required to give an account of the manner in which they had discharged their duties; if found blameless, they became members of the Areopagus.

The name archon is frequently applied by Greek authors to magistrates in general; it was also used as a title under the Greek empire, and the Jews sometimes applied it to members of their Sanhedrim.

ARCHYTAS, of Tarentum, son of Mnesagoras or Histæus, was one of the most celebrated men of antiquity. He was distinguished as a mathematician, a philosopher, a statesman, and a general, nor was he less remarkable for the purity and integrity of his life and the mildness and benevolence of his disposition. The time at which he flourished can be settled approximately from the fact that he was contemporary with Plato, whom he knew personally, and whose life he saved by interceding with the tyrant Dionysius.

ARCIS-SUR-AUBE, the chief town of the arrondissement of the same name, in the department of Aube, in France, is situated about 17 miles (28 kilometres) north of Troyes, on the left bank of the river, just at the point where it becomes navigable. Population, 3,000.

ARCOS DE LA FRONTERA, a Spanish town in the province of Cadiz, on the river Guadalete, which flows past Santa Maria into the bay of Cadiz. The special designation "of the frontier" is due to its position as a border town after its capture from the Moors by Alphonso the Wise. Population, 16,280.

ARCOT, two districts and a city of British India, within the presidency of Madras, and under the jurisdiction of the governor of that province. The district of **NORTH ARCOT** lies between $12^{\circ} 22'$ and $14^{\circ} 11'$ N. lat.; and between $78^{\circ} 17'$ and $80^{\circ} 12'$ E. long. It is bounded on the north by the district of Cuddapah and Nellor; on the east by the district of Chengalpat; on the south by the districts of South Arcot and Salem; and on the west by the Mysor territory. The area of North Arcot is 7,616 square miles; the population as ascertained by a census taken in July, 1891, being 2,180,487 souls. **SOUTH ARCOT** has an area of 5,217 square miles and a population of 2,162,851.

ARCOT CITY, the principal town in the district of North Arcot, is situated on the south bank of the Palār river, in $12^{\circ} 54'$ N. lat., and $79^{\circ} 24'$ E. long. It is a station on the line of railway from Madras to Beypur, and is also a military cantonment. The population of the town is about 15,000.

ARCTIC means, properly, lying near the constellation of the Bear (Gr. *arctos*) or Ursa Major, and hence, northern. The Arctic Circle is a circle drawn round the North Pole, at a distance from it equal to the obliquity of the ecliptic, or $23\frac{1}{2}^{\circ}$. The corresponding circle round the South Pole is the Antarctic Circle.

ARCTIC ANIMALS. The region north of the cultivation of cereals is peopled by a limited and homogeneous fauna. Mammals are represented almost exclusively by ruminants, carnivores, and rodents, such as the Arctic fox, polar bear, glutton, ermine, sable, walrus, tailless hare, lemming, reindeer, and musk-ox. Birds are represented especially by the snow-partridges, snowy owl, Iceland falcon, eider-duck, auks, divers and guillemots. No reptiles can live in the cold of the Arctic regions; but fishes, especially Salmonidæ, are well represented. Insects and molluscs are fairly numerous. Not a few of the birds and mammals inhabiting these snowy regions exhibit adaptive characteristics of white color, thick coats, accumulations of fat, and the like.

ARCTIC OCEAN. The Arctic Circle ($66^{\circ} 30'$) being taken as a boundary, the whole of the ocean lying to the north is called the Arctic Ocean. From a physical point of view this limit is hardly satisfactory, since between Greenland and Europe the Atlantic, with its Gulf Stream, makes an inroad on the Arctic territory, and the southern extremity of Greenland brings down the Arctic region beyond the Arctic limit; but the other parallel of latitude (70°) which has been chosen as a southern limit is perhaps still more objectionable. The Arctic Ocean washes the north of Europe, Asia, and

America. It communicates with the Atlantic by a broad opening on the east of Greenland, and a narrow but important channel on the west, which has been traced as far north as 84° , and is known in the various parts of its extent by special names—Davis' Strait, Baffin's Bay, Utlak Soak, Smith Sound, Kennedy Channel, Robeson Channel, Lincoln Sea,—but might conveniently be distinguished by some such general designation as the West Greenland Channel. With the Pacific there is communication between Asia and America through Behring's Strait. Europe sends down the Onega, Dwina, Pinega, Mezen, and Petchora; Asia the Obi, Yenisee, Lena, Indigarka, and Robima; and America the Mackenzie River. The most important of the numerous islands are Spitzbergen and Nova Zembla, with the multitudinous adjacent islets, to the north of Europe; the Liakhove Islands, or New Siberia, off the coast of Asia; and the vast irregular archipelago into which the north-eastern portion of America is split, which extends to the quasi-continent of Greenland.

ARDEA, a Latin city, probably of Pelasgian origin, famous chiefly for its accidental connection with the semi-mythical rape of Lucretia and the expulsion of the Tarquins from Rome.

ARDEBIL, or **ARDABIL**, one of the chief towns of Azerbaijan in Persia, situated in $38^{\circ} 15'$ N. lat., and $48^{\circ} 19'$ E. long., on the Karasau or Baluk, a tributary of the Aras, in a fertile plain about 40 miles from the Caspian, seems to have been built out of the ruins of a former city. Population, about 10,000.

ARDECHÉ, a department in the south of France, bounded on the northwest by the department of Loire, on the east by Isère and Drôme, on the south by Gard, and on the west by Lozère and Haute Loire. It extends 72 miles from north to south and 45 from east to west, at the widest points; its area is 2,136 square miles. The surface of Ardèche is almost entirely covered by the Cevennes Mountains; the main line forming the western boundary of the department, and sending out the Boutières, Coiron, Tanargue, and other branches, for the most part in an easterly direction. Several of the summits, of which the highest, Mount Mezenc, is 5,972 feet above the sea, are evidently extinct volcanoes. The Rhone bounds Ardèche on the east, and receives most of its rivers, including the Cance, the Ay, the Doux, the Erioux, and the Ardèche. A few rivers, however, belong to the Atlantic side of the water-shed, the chief being the Loire, which rises on the western borders of the department, and the Allier, which for a short distance separates it from Lozère. The climate in the valley of the Rhone is warm, and sometimes very hot; but westward, as the elevation increases, the cold becomes more intense and the winters longer. Population, 375,472.

ARDELAN, a province of Persia, forming the eastern division of Kurdistan, and lying south of Azerbaijan. Its capital, Kermanshah, in long. 40° E. and lat. $35^{\circ} 12'$ N., is built in a deep valley, which is well tilled and rich in orchards. Area, 6,000 square miles. Population, 150,000.

ARDENNES, a department on the northeast frontier of France, which derives its name from the famous forest, is bounded on the north and northeast by Belgium, on the east by the department of the Meuse, on the south by that of Marne, and on the west by that of the Aisne. In shape it is an irregular pentagon, with a cape-like prolongation into Belgium on the north. It has a superficial extent of 523,000 hectares, or 1,291,810 acres, of which 300,000 hectares, or 741,000 acres, are arable land, while 154,000 hectares, or 383,800 acres, are occupied with forest, wood, and heath. The wooded plateaus which begin in the department of the Meuse are continued in a north-

west direction, and divide the basin of the Meuse from the basin of the Aisne, till they form a junction with the Ardennes proper. At one time this was a very inaccessible region, and formed a strong defense, as Dumouriez showed in 1792, against invasion from the east. The chief wealth of Ardennes consists in mineral productions, wood, cattle and sheep. The department is divided into five arrondissements: Mézières, toward the center; Rocroy in the north; Rethel in the west and south; Vouziers in the south; and Sedan in the east. Mézières is the capital, and a prefecture. Population, (1901), 314,056; area, 2,020 square miles.

ARDFERT, a small village in Kerry, in the southwest of Ireland, about four miles north-northwest of Tralee, and nearly as much from the coast.

ARDGLASS (*the green height*), a town of Ireland in Down county, Ulster, at the head of a small bay about eight or nine miles south of the entrance of Strangford Lough, and seven miles south-southeast of Downpatrick, was a place of great importance soon after the Norman invasion.

ARDOCH, a parish in Perthshire, famous for its Roman military antiquities, which are situated in the grounds of Ardoch House, about two and one-half miles north of Greenloaning, on the Caledonian railway.

ARDRES, a French town, in the department of Pas de Calais, and arrondissement of St. Omer, on a canal joining Calais and St. Omer, to which it gives its name. The "Field of the Cloth of Gold," where Henry VIII. of England and Francis I. of France tried to outdazzle each other in 1520, was in the immediate neighborhood.

ARDROSSAN, a seaport in Ayrshire, Scotland, 31 miles by rail from Glasgow, in N. lat. $55^{\circ} 38'$, and W. long. $4^{\circ} 49'$. It dates from an early period, as there seem to have been a castle and a small fishing village in existence for several centuries. The castle, famous for its capture by Wallace, was finally destroyed by Cromwell, who is said to have used part of its masonry for the construction of the fort at Ayr.

ARE (Lat. *area*) the unit of the French land-measure, is a square, the side of which is 10 metres (or 32.809 feet) long, and which therefore contains 100 square meters = 119.6 English square yards. The next denomination in the ascending scale is the *decare*, containing 10 ares; but the denomination commonly used in describing a quantity of land is the *hectare* of 100 ares, = 2.47 English statute or imperial acres.

AREA (Lat.) is a term in mathematics meaning *quantity of surface*. The calculation of areas, or mensuration of surfaces, is one of the objects of geometry.

ARECA, a genus of palm, containing several species, having pinnate leaves and double spathes. The fruit is a fibrous one-seeded drupe, a nut with an outer fibrous husk. *A. catechu*, the Penang Palm, or Betel-nut Palm, is a native of the East Indies, whose nut yields a sort of catechu. This areca-nut, or betel-nut, is very much used in many parts of the East, the chewing of it with quicklime and the leaf of the betel-pepper being one of the most prevalent habits of the people. *A. oleracea*, the Cabbage Palm of the West Indies, is a very tall tree, 100 to 200 feet, whose huge terminal leaf-bud is sweet and nutritious, and is sometimes used for the table as cabbage, but when it is cut off, the tree is destroyed. The stem of this tree, notwithstanding its great height, is remarkably slender. *A. sapida*, the New Zealand Palm, is remarkable as extending southward beyond the geographical limits of any other of its order, as far indeed as $38^{\circ} 22'$ S. latitude. It is a small palm, only from six to ten feet high, with leaves four to six feet long.

ARECIBO, a town of Porto Rico, third in size in the province. Population, 12,000.

AREMBERG, a small market-town of Prussia, in the government of Coblenz and circle of Adenau. It is situated not far from the river Ahr, and has a castle which was formerly the residence of the dukes of Aremberg.

ARENA, a part of an amphitheatre, where the combats of gladiators and wild beasts took place. It was so called because it was usually strewn with sand. (Lat. *arena*.)

ARENACEOUS ROCKS. All rocks composed entirely or to a large extent of grains of quartz are included under this title.

ARENDAL, a seaport town of Norway on the Skagerrack, 35 miles from Christiansand. Pop. 7,000.

AREOPAGUS, a small barren hill to the west and within bowshot of the Acropolis of Athens, for an attack upon which it would form a natural base. It was so used (480 B.C.) by the Persians. For the same purpose it had been occupied also in the legendary age by the Amazons, when in the time of Theseus they menaced Athens, and from the circumstance of their having then sacrificed to Ares, the hill derived its name. Assuming the occupation by the Amazons to have been typical of what frequently happened during the hostilities of early times, it is easy to understand how the hill became associated with the war god. To the popular mind the Areopagus was always the "hill of Mars." But the popular mind required a more definite account of the origin of the name, and to supply this, there took shape the legend of Ares having been here called before a court of the twelve gods to answer for the murder of Halirrhothius. This explains at once the origin of the name of the hill and of the court which held its sittings there. Æschylus, however, gives in the *Eumenides* a different origin to the court, declaring it to have been first appointed by Athene to try Orestes for the murder of his mother Clytemnestra. In later times both legends were dismissed, and the explanation of the name referred to the nature of the cases—cases of murder—tried before the court. The four legendary cases of murder tried before this court were those in which Ares, Cephalus, Dædalus, and Orestes appeared as the accused. On the top of the hill toward the east is an artificial plateau accessible from the south by steps cut in the rock. In several places are still to be traced the rock-hewn seats on which the court sat in the open air, so that the judges and accusers might not be under the same roof with a polluted criminal. Raised upon two unhewn stones, the accuser and the accused made their pleadings, the stone used by the former being called "stone of implacability;" the other was called "stone of crime." Within the boundary of the court stood also an altar to Athene Areia, believed to have been dedicated by Orestes, and blocks of marble on which were inscribed the laws defining the powers of the judges. On another part of the hill stood one of the most revered of Athenian sanctuaries, that of the Erinnyes, containing statues of these three goddesses, but not in the hideous aspect in which they were usually conceived, and also statues of those other deities connected with the lower world, Pluto, Hermes, and Ge. Within the boundary of this temple was the tomb of Œdipus, and very close to the boundary, if not within it, was the heroön or sanctuary of Hesychus, the founder of the priestly line in whose hands were the rites of the Erinnyes. Near the temple was the Cylonion, a memorial of the pollution of the spot caused by the treacherous slaughter of those who, having failed in the conspiracy of Ceylon, had taken refuge there as suppliants.

AREQUIPA, one of the 18 departments of Peru. It lies along the Pacific from lat. 15° to $17^{\circ} 20'$ S. Its chief productions are silver, alpaca and other wools, sugar, wine, and brandy. The population is stated at 230,000, which is probably in excess.

AREQUIPA, the chief town of the department, stands at the foot of Mista, in the fertile valley of the Chile, 7775 feet above the level of the sea, in lat. $16^{\circ} 16'$ S., long. $72^{\circ} 31'$ W. It is divided into five districts—Santo Domingo, San Francisco, La Merced, San Augustin, and Miraflores—and has a population of about 30,000.

ARES [**MARS**], in *Greek Mythology*, the god of war, not, however, of war in its wide sense, including campaigns, the disposition and command of forces, but in its more primitive meaning of a fierce encounter between bodies of men. Neither the causes nor the ultimate effects of war were ascribed to him. He was simply a personification of the wild impetuous spirit with which battles were fought, and as such he was conceived as the model of a hero, splendidly armed with cuirass, helmet, shield, and spear, swift, of great size (*πελώριος*), raging (*μαινόμενος*), murderous (*βροτολογιός*), unsatiable of war, (*ἄτος πολέμοιο*). Enyo, the furious war goddess, Eris, (*Strife*), Deimos and Phobos (*Dread and alarm*), were usually by his side. Even his mother Hera denounces him (*Iliad* v. 761) as senseless, and knowing no bounds. It was doubtless only as an illustration of the habitual strife between Hera and Zeus that Ares was accounted their son. When wounded by Diomedes assisted by Athena (*Iliad* v. 858, *ff.*), he fell with a noise like that of nine or ten thousand men in battle; and again (*Iliad*, xxi. 400 *ff.*), when Athena wounded him with a stone, he fell, and covered with his fall seven acres of ground.

ARESON, **JON** or (**HANS**) a poet, and the last Roman Catholic bishop in Iceland, was born in 1484. He endured many privations in his youth, and at the age of twenty took holy orders and was attached as priest to the parish of Helgastad. Here he was taken under the protection of Gottskalk, bishop of Holum, who twice sent him on missions to Norway. He acquitted himself so well that in 1522 he was appointed successor to Gottskalk. To many his election was displeasing, chiefly on account of his ignorance of Latin; and Ogmund, bishop of Skalholt, the other diocese, drove Areson with violence from his bishopric. He was re-instated in 1524, and spent some rather stormy years till 1540, when Frederic III., king of Denmark, wrote to the bishops of Iceland desiring them to take measures for the introduction of Lutheranism. This Areson declined to do, and he even denied the king's power as head of the church. The greater part of the island, however, became Protestant. In 1548 the Lutheran bishop of Skalholt died, and Areson made an armed excursion into his successor's territory. For this he was in 1549 declared an outlaw. He again sent an expedition against Skalholt, and captured the bishop, whom he treated with indignity. In 1550 his forces were defeated; he was taken, and executed along with two of his sons. Areson is celebrated as a poet, and as having been the first to introduce printing into Iceland. Several of his poems are collected by Harboe in his *History of the Reformation in Iceland*.

ARETÆUS, a Greek physician of Cappadocia, who lived, according to some, in the reign of Augustus; according to others, under Trajan or Hadrian. He was one of the class of Pneumatic physicians, who made the heart the seat of life and of the soul.

ARETHUSA, a fountain at Syracuse, in Sicily, famed among the ancients for the abundance of its waters and the number of its fishes, but still more so

for the connection which was fabled to exist between it and Alpheus, the river of the Peloponnesus, "who stole under seas to meet his Arethuse." According to the anthropomorphic legend, Arethusa was a daughter of Nereus and Doris, who was changed into the fountain by her mistress Diana (Artemis), to deliver her from the pursuit of her lover Alpheus. There is still a copious supply of water in the modern fountain, but the taste is brackish, and it can only be used for washing; while the fish are no longer to be found.

ARETHUSA was also the name of two cities: Arethusa in Macedonia, famous for the tomb of Euripides, and Arethusa in Syria (*Rastan*), which gives its name to Marcus, a bishop who was persecuted by the Arethusians, and is honored as a martyr by the Greek Church.

ARETINO, **PIETRO**, an Italian writer of the 16th century, was born in 1492 at Arezzo in Tuscany, from which place he took his name. He received little education, and lived for some years poor and neglected, picking up such scraps of information as he could. After some years' wandering through parts of Italy he reached Rome, where his talents, wit, and impudence commended him to the Papal Court. This favor, however, he lost, left Rome and was received by John de Medici, who took him to Milan and introduced him to Francis I. He gained the good graces of that monarch, and received handsome presents from him. On the death of John de Medici in December 1526, he withdrew to Venice, where he spent his time in writing comedies, sonnets, licentious dialogues, and a few devotional and religious works. He led a profligate life, and procured funds to satisfy his needs by writing sycophantish letters to all the nobles and princes with whom he was acquainted. This plan proved eminently successful, for large sums were given him, apparently from fear of his satire. So great did Aretino's pride grow, that he styled himself the "divine," and the "scourge of princes." He died in 1557, according to some accounts by falling from his chair in a fit of laughter caused by hearing some indecent story of his sisters. The reputation of Aretino in his own time rested chiefly on his satirical sonnets or burlesques; but his comedies, five in number, are now considered the best of his works.

AREZZO, the ancient **ARRETIVM**, a Tuscan city on the Chiana (*Clanis*), which is now an affluent of the Arno, but formerly flowed into the Tiber. Arretium was one of the twelve cities of the ancient Etruscan Confederation, and continued after its incorporation with the Roman dominion to be a highly important military post. Having sided with Marius in the civil war, the Arretines were deprived by Sulla of their Roman citizenship; but the city received a colony under Augustus, and seems to have had a peculiar municipal constitution. In the time of Pliny it was known for its pottery, and many specimens of the bright red ware, with ornaments in relief, differing from the productions of Southern Etruria, have been preserved to the present day. In modern history Arezzo is chiefly remarkable for the obstinate opposition it maintained against the pertinacious encroachments of the Florentines, to whom, however, it had finally to submit. It is now a clean, well-built, well-paved, and flourishing town of 10,000 inhabitants, the seat of a bishop and a prefect, with a theological seminary, a surgical school, a library, and a museum. Few cities can show such a list of remarkable men as Arezzo—Mæcenas (?), Guido, famous for his musical discoveries, Guitone the poet, Petrarch, Leonardo Bruno the historian, Cesalpini the botanist, Margheritone and Spinello the painters, Alberghotti the jurist, Pope Julius III., Pietro Aretino, the satirist, Vasari the author of *Lives of the Artists*, Redi the naturalist, Fossombroni the mathematician and engineer.



ARGENTINE REPUBLIC

ARGAM, a village of Haidarábád, in the Nizám's dominions, 40 miles south-west of Elichpur and 135 miles north-east of Aurungábád.

ARGELANDER, **FRIEDRICH WILHELM AUGUST**, a distinguished German astronomer, was born at Memel, 22d March 1799; and died at Bonn, 17th February 1875. He studied at the university of Königsberg, where his attention was attracted to the study of astronomy by Bessel, whose assistant he became in 1821. In the following year he published an essay on the path of the great comet of 1811, the period of which he determined with great accuracy. In 1823 he was made superintendent of the observatory at Abo; and in 1832 was transferred to the university of Helsingfors, where he remained for five years. In 1837 he published an admirable essay upon the proper motion of the solar system, and in the same year was appointed professor of astronomy at Bonn, where he spent the remainder of his life.

ARGENSOLA, the name of two Spanish poets, brothers, who are sometimes called the "Spanish Horaces." The elder, Luperio Leonardo y Argensola, was born in 1565 and died in 1613. His works consist of three tragedies, highly praised by Cervantes, and lyric poems, published along with those of his brother.

ARGENTAN, a town in the department of Orne, in France, situated in the midst of a fertile plain at the junction of the Ure and Orne, about 31 miles from Alençon. Population about 8,000.

ARGENTEUIL, a market-town of France, in the department of Seine-et-Oise, and arrondissement of Versailles, on the Seine. It gathered round a monastery, which, dating from 656 A.D., was by Charlemagne changed into a nunnery, afterwards famous for its connection with Heloise, and on her expulsion in 1129, was again turned into a monastery. Population, 8,126.

ARGENTINE REPUBLIC. THE ARGENTINE REPUBLIC comprises the greater part of what was formerly the Spanish viceroyalty of Buenos Ayres. On the separation of the country from Spain the remainder of the viceroyalty seceded from the authority of the government established at Buenos Ayres, and formed the three important republics of Bolivia, Paraguay, and the Banda Oriental del Uruguay, commonly called either the Oriental Republic or Uruguay. The city of Buenos Ayres, the capital of the province of the same name, then became the seat of the national government of the United Provinces of the Rio de la Plata,—so named in the treaty with England, by which their independence was recognized, and since termed the Argentine Republic. Including the Indian tribes, who are in almost undisputed possession of half its territory, the country does not contain half so many inhabitants as the city of London, though it extends over an area as great as all Central and Western Europe combined; and the fertility of its vast plains, together with the yet undeveloped wealth of its mineral resources, indicate that it is well able to sustain as numerous a population as that of the part of Europe just alluded to. Its extent in latitude is greater than that of any other existing country, if we except the comparatively useless regions of British America and those of the Russian empire, though it only slightly exceeds that of the comparatively narrow slip of land which forms the neighboring Republic of Chili. It is bounded on the W. by Chili; on the S. by the Strait of Magellan; on the E. by the Atlantic Ocean, the Oriental Republic, the Empire of Brazil, and the Republic of Paraguay; and on the N. by the Romans, so far as that activity manifested itself in works of form and substance as opposed to the artistic expression of thought by unsubstantial means, as in the case of poetry or music. It ranges from the Greek temple as the highest form of artistic expression in this sense to

Buenos Ayres July 23, 1881, by which Patagonia became a part of the Republic, the Strait of Magellan being apportioned to Chili. The broad stream of the Uruguay below its tributary, the Guarey, or Cuareim, divides it from the Oriental Republic, except that the small but important island of Martin Garcia, close to the Oriental shore of the Uruguay at its junction with the Parana, belongs to the Argentine Republic. The boundary with Brazil is then formed by the Uruguay and its tributary, the Pepiri Guazu, from the head waters of which it crosses the Sierra de los Misiones to the head waters of the San Antonia Guazu, the course of which it follows, and then that of the Igazu, or Rio Grande de Caritiba, an important tributary of the Parana. The Parana, down to its junction with the Paraguay, and the latter upwards as far as the mouth of the Pilcomayo, form the boundary with the Republic of Paraguay. South of the 22d degree of latitude the country between the Pilcomayo and the Paraguay is disputed by the Argentine Republic and Paraguay. The boundary with Bolivia lies along the 22d degree of latitude between the Pilcomayo and the Vermejo, and then, leaving important tributaries of the latter to Bolivia, it follows the course of that river to its source, whence it takes a devious course westwards among the mountains which form spurs to the Andes. On reaching the latter it follows the main chain southwards to latitude 25° 30', where it passes to a more westerly ridge of the Andes on which the boundaries of the three neighboring republics unite. The boundary we have described with Bolivia cannot be considered as permanently settled; and the boundary between Bolivia and Paraguay to the north of the Argentine Republic has not been determined. The boundary questions with all these republics are in an unsatisfactory state.

The most remarkable feature of the country is its plains, which may be said to extend over more than three-fourths of it. The plains of Patagonia in the south, the Pampas across the extending central part of the country, and the Chaco in the north-east, have no very definite natural boundaries. The two latter are, in fact, the same continuous formation, in which a slight undulation divides the streams of the Chaco, which join the Parana, from those of the Pampas, which either flow into the Atlantic south of the mouth of the latter river, or disappear by absorption into the soil, and evaporation as they spread over the plains. The best parts of these plains are covered with a rich alluvial soil from 3 to 6 feet in thickness, formed by the constant decaying of the luxuriant vegetation which grows upon it, and this soil rests upon a sedimentary deposit of earth, which appears to have been scoured away from the Andes and the high lands of the central part of the continent. A great part of Patagonia and the western Pampas consists of gravel and coarse detritus from the Andes, and, though apparently sterile, only requires irrigation to become productive. Other parts of the plains are dry, saline wastes or brackish marshes, which probably mark the former position of an inland sea. Excepting the hills in the south of the province of Buenos Ayres and those of Cordova, the mountain districts of the country consist of the eastern slope of the gigantic range of the Andes and its branches, which latter make all the north-western part of the country a mountainous region. The great chain of the Andes consists of a confused mass of broken and contorted strata, piled upon an elevated ridge of granite, through pation of the soil, are now accredited the authors of this primitive masonry, to which accordingly the much-abused term Pelasgic is applied. Pausanias (i. 28, 3) describes the oldest part of the walls of the Acropolis at Athens as the work of Pelasgic settlers there. In

which fertile valleys are formed in many places, whilst in other parts the separation between them is not very clearly defined. In the north-west the boundary with Bolivia lies along the most eastern of the ridges just mentioned, so that the valleys to the west of it are within that republic, but the boundary with Chili lies along the western ridge, so that the central and eastern ridges, with the fine valleys which lie between them, belong to the Argentine Republic.

The great extent of this country in latitude makes its climate range through all diversities of temperature from that of Northern Europe and Canada to that of Egypt and Arabia. The climate of Southern Patagonia is less intemperate than that of Labrador at the same distance from the equator in the northern hemisphere, but colder than the Atlantic shores of Europe in the same latitude. As the difference of climate in the same latitude in the northern hemisphere is in a great measure attributed to the fact of the warm water from the equatorial regions drifting towards the shores of the north of Europe, whilst the cold water from the Arctic regions is constantly flowing southwards along the coast of Labrador, so also the intermediate nature of the climate of Patagonia is doubtless, in some measure, due to the tendency of the cold water of the Antarctic regions to flow northwards through the central parts of the Atlantic Ocean, as pointed out by Maury, thus throwing the warm water southwards along the coasts of Brazil and Patagonia. Argentine Patagonia might, not inaptly, be termed the Sweden, and Chilian Patagonia the Norway of the southern hemisphere. In the north of Patagonia and the southern part of the province of Buenos Ayres the climate, as regards temperature, resembles that of England; and northwards of this is the broadest part of the republic, which contains the city of Mendoza in the far west, and Buenos Ayres in the east, and enjoys one of the finest climates in the world, rivalling that of Southern France and Northern Italy. North of this the summer heat becomes too oppressive, and in the extreme north the climate is thoroughly tropical. In some parts of the north-west the altitude of the country gives it a cooler climate than that of the Chaco in the same latitude. Along the Argentine slopes of the Andes and the adjacent country the climate is remarkable for its dryness, because the prevalent westerly winds lose the moisture which they bring from the Pacific before crossing the mountains. This peculiarity is most marked in the southern part of the continent, where Chilian Patagonia is deluged with almost incessant rain, whilst Argentine Patagonia is dry and arid. In the east, as at Buenos Ayres, there is more rain, which, with southerly winds and occasional north-westerly storms, is often very heavy. The oppressive humidity which is characteristic of the northerly and north-easterly winds forms the most disagreeable and unhealthy weather experienced in that part of the country. The climate of Cordova, and also that of some of the more westerly districts is found very suitable for consumptive patients.

The first Europeans who visited the River Plate were a party of Spanish explorers in search of a south-west passage to the East Indies. Their leader, Juan Dias de Solis, landed, in 1516, with a few attendants, on the north coast between Maldonado and Monte Video, where, according to Southey, they were treacherously killed, and then cooked and eaten by the Charrua Indians in sight of their companions on board the vessels. The survivors at once abandoned the country and returned to Spain, reporting the discovery of a fresh-water sea. In 1519 Magalhaens, in the services of the king of Portugal, entered this fresh-water sea, or Mar Dulce, as it was then called, but finding no passage to the west,

he left it without landing, and then achieved his great voyage to the English Indies, passing through the strait which bears his name in 1520. After this Sebastian Cabot, already a renowned navigator, who, in the service of Henry VII. of England, had attempted to find a north-west passage to the East Indies, entered the service of Charles I. of Spain, and sailed in command of an expedition fitted out for the purpose of colonising the discoveries of Magalhaens in the East Indies. He, however, entered the River Plate in 1527, and anchored off the present site of the city of Buenos Ayres. He then ascended the Parana, and established a settlement, named San Espiritu, among the Timbú Indians in Santa Fé; and he succeeded in bringing that tribe of Indians to friendly terms with the colony. He continued the ascent of the Parana as far as the cataracts in Misiones, and afterwards explored the Paraguay, from which he entered the Veremejo, where his party suffered severely in a savage fight with the Agaces, or Payaguá Indians. Of this tribe a subdued remnant now lives on the delta of the Pilcomayo, opposite Asuncion, amalgamating neither with the Spaniards nor with the wild Guaycurus of the surrounding parts of the Chaco. The profusion of silver ornaments worn by these Indians, as well as by the Timbus and Guaranis, led him to give the name of Río de la Plata, or Silver River, to the splendid stream which he had thus far explored. This name, rendered in English *River Plate*, is now applied only to the estuary below the junction of the Paraná and Uruguay. One of Cabot's lieutenants, detached on a separate exploring expedition up the Uruguay, was killed, together with a great part of his crew, by the Charrua Indians. And subsequently at San Espiritu, an attempt of the chief of the Timbus to obtain possession of one of the Spanish ladies in the settlement led to a treacherous massacre of the garrison. Before this latter occurrence Diego Garcia arrived in the river with an expedition fitted out in Spain, for the purpose of continuing the explorations commenced by De Solis; and Cabot returned to Spain, where he applied to Charles I. for the means of opening communications with Peru by way of the Veremejo. But the resources of the king were absorbed in his struggle as emperor (under the name of Charles V.) with Francis I. of France, so that he was obliged to leave the enterprise of South American discoveries to his wealthy nobles. In August 1534 Mendoza left Cadiz for the river Plate at the head of the largest and wealthiest expedition that had ever left Europe for the New World. In January 1535 he entered the River Plate, where he followed the northern shore to San Gabriel, and then crossing the river, he landed on the Pampas. The name of Buenos Ayres was given to the country by Del Campo, who first stepped ashore where the city of that name now stands, and where, on the 2d February, the settlement of Santa Maria de Buenos Ayres was founded; the smaller vessels having been safely harbored in the Riachuelo, half a league south of the settlement. Mendoza's captains then explored the country between Paraguay and Peru, in which latter country Pizarro had, in 1535, founded the city of Lima. Of one of these expeditions consisting of 200 men, who left Paraguay in February 1537, and are said to have reached the south-east district of Peru, under Ayolas, every man was killed by the Payagua Indians in the northern part of the Chaco whilst the expedition was returning laden with plunder. Ayolas had, on his way up the river, built and garrisoned a fort named Corpus Christi among the Timbus in Santa Fé, near the deserted settlement of San Espiritu; and in Paraguay, after three days' fighting with the Guaraní Indians, as narrated by Du Graty, he had, on the 15th August 1536,

established a settlement where the city of Asuncion now stands. In the meantime the settlement of Buenos Ayres was attacked and burnt by the Indians; and after terrible sufferings from famine as well as attacks of the Indians, jaguars, and pumas, the Spaniards abandoned the place on the arrival of a fresh expedition from Spain, in company with which they ascended the river, first to Corpus Christi, and then to Asuncion, where, in 1538, Irala was elected captain-general. In 1542 Buenos Ayres was re-established by an expedition sent out from Spain for the purpose under Cebesa de Vaca. This able leader landed at Santa Catherina, in Brazil, and marched overland to Asuncion, from which he sent vessels to join the new expedition at Buenos Ayres, reaching that place, according to Southey, just in time to save the new comers from extermination by the Indians. Here the Spaniards again found themselves unable to withstand the incessant attacks of the savages, and the place was a second time abandoned on the 3d February 1543. At Asuncion the Spaniards were more successful in establishing themselves among the Guaraní Indians, who, after much severe fighting, finding themselves unable to vanquish the Spaniards, made alliance with them, both offensive and defensive, and also intermarried with them. The events which transpired at Asuncion belong, however, to the history of Paraguay. In 1573 Garay, at the head of an expedition despatched from Asuncion, founded the city of Santa Fé near the abandoned settlements of San Espiritu and Corpus Christi. The expulsion of the Spaniards from the latter place, had according to the *Historia Argentina*, resulted from a wanton attack made by them on the Caracara Indians, slaughtering the men, and taking the women captive,—a mode of procedure which all Pampa Indians adopted, and have ever since acted on. It is unfortunate, both for the Indians and for the Spaniards, that the bold *conquistadores* were not always under the guidance of such high principled men as Cabot and Cabeza de Vaca. In 1580, when the new colony had been firmly established, Garay proceeded southwards and made the third attempt to establish Buenos Ayres, under the name "Cuidad de la Santissima Trinidad, Puerto de Santa Maria de Buenos Ayres;" and notwithstanding the determined hostility of the Querandi Indians, who were encouraged by the success of their two preceding wars, the Spaniards succeeded in holding the place. The settlement prospered, and the cattle and horses brought from Europe multiplied and spread over the plains of the Pampas. Whilst the Spaniards of the River Plate were thus engaged, Pizarro had effected the conquest of Peru; and his lieutenant, Almagro, had extended the conquest to the south of Chili, from which, in 1559, Hurtado de Mendoza crossed the Andes, and, having defeated the Araucanian Indians, founded the city of Mendoza. It is interesting to observe, that up to a recent date the giant chain of the Andes has been a less effective barrier to trade than the rich plains of the Pampas. This state of affairs is, however, now much altered by the railway, for which Mr. Clark, several years ago, obtained a concession, direct from Buenos Ayres to Mendoza. In 1550 the Spaniards from Peru entered the north-western provinces by way of Catamarca, and founded the city of Tucuman in 1565, and that of Cordova in 1573. It was only in 1873, just three hundred years after the cities were founded, that the boundary between the jurisdiction of Cordova and that of Santa Fé was determined by the intervention of the national Government. In 1620 Buenos Ayres was separated from the authority of the Government established at Asuncion, and was made the seat of a Government extending over Mendoza, Santa Fé, Entre Rios, and

Corrientes, but at the same time remained, like the Government at Asuncion and that of Tucuman, which latter included Cordova, subject to the authority of the viceroyalty of Peru.

After the vast expenditure of blood and treasure which was incurred by the Spaniards in establishing themselves on the River Plate as just described, the restrictive legislation of the home Government became a more effective hindrance to the development of its resources and the spread of civilisation over the country than the hostility of the Indian tribes. Cabot had urged the feasibility of opening an easier channel for trade with the interior of Peru through the River Plate and its tributaries than that by way of the West Indies and Panama; and, now that his views seemed about to succeed, the interests of the trade, which had in the meantime been established by the northern route, combined to crush the threatened development of that of the River Plate. Spanish legislation endeavored to exclude all European nations except Spain from the trade by way of the West Indies and to prevent any trade from being transacted by way of the River Plate, thus enacting most flagrant injustice towards the people it had encouraged to settle in the latter country. The hardy pioneers of European civilisation in these regions so far overcame the pernicious influences which acted upon Spanish legislation, that in 1602 they obtained permission to export two shiploads of produce a year. But, to prevent internal trade with Peru, a custom-house was established at Cordova, to levy a duty of fifty per cent. on everything in transit to or from the River Plate. In 1665 a relaxation of this system was brought about by the continued remonstrances of the people; and in 1774 free trade was permitted between several of the American posts. In 1776, with a view to better maintaining the country against the encroachments of the Portuguese in their colonies in Brazil, Buenos Ayres was decreed the capital of a viceroyalty, with jurisdiction over the territories of the present republics of Bolivia, Paraguay, Uruguay, and the Argentine Confederation. All this country was then opened to Spanish trade, even with Peru, and the development of its resources, so long thwarted, was allowed comparatively free play. From this time a succession of viceroys exercised jurisdiction over the whole of these territories. Velasco, however, was made governor of the semi-civilized Indians in the Jesuit settlement of Misiones on the Rivers Parana and Uruguay, subject only to the direct authority of the home Government; and in 1806 he became also governor of the province of Paraguay, under the authority of the viceroyalty of Buenos Ayres, and these offices he still held when the independence of the country was declared.

The authority of the viceroys was interrupted in the lower part of the River Plate during the wars between England and Spain. On the 27th June 1806 General Beresford landed with a body of troops from a British fleet under command of Sir Home Popham, and obtained possession of the city of Buenos Ayres. The viceroy, Sobremonte, retired to Cordova, where Liniers collected an army from all parts of the country, with which, on the 12th August, he assaulted the city, and Beresford, with his troops surrendered. In the meantime Sir Home Popham had taken Maldonado; and in February 1807, Sir Samuel Auchmuty stormed and took the city of Monte Video. In May 1808 General Whitelock, with 8,000 men, endeavored to regain possession of Buenos Ayres; but the inhabitants had made great preparations for resistance, and as all the houses were at that time built with their windows opening on the streets, protected with strong iron railings like prison bars, and with flat roofs, each one was of itself a fortress; so that after suffering terrible slaughter in the

long straight streets of the city, the invading army capitulated, agreeing to abandon both banks of the River Plate within two months. Whitelock was brought before a court-martial appointed to inquire into the cause of the failure of the enterprise entrusted to him; the indignation excited against him in England, in consequence of his want of success, was as great as that excited on the River Plate against the viceroy, Sobremonte, in consequence of the first success of the English. The events which we have narrated tended to give self-confidence to the people of Buenos Ayres, who, on applying to the home Government for assistance against the English, had been told that they must protect themselves. But the disturbances which ultimately led to the separation of the country from Spain were initiated by the refusal of the Argentines to acknowledge the Napoleonic dynasty established at Madrid. Liniers, who was viceroy on the arrival of the news of the crowning of Joseph Buonaparte as king of Spain, was deposed by the adherents of Ferdinand VII.; and on the 19th July 1809 Cisneros became viceroy in the name of Ferdinand. In compliance with the urgent appeals of the people, he opened the trade of the country to foreign nations; and on the 25th May 1810, a council was formed, with his consent, under the title of the Provisional Government of the provinces of the Rio de la Plata. This has since been regarded as the commencement of the era of the political independence of the country. Of this council Mariano Morino, the secretary, was the most prominent member, and the people of the city of Buenos Ayres were for some time its only effective supporters. An attempt of the Spanish party to make Cisneros president of the council failed, and he retired to Monte Video. On the 31st January 1813 a congress was assembled at Buenos Ayres, and Posadas was elected dictator of the republic. Monte Video still supported the cause of Spain, but was besieged by the revolutionary army of Buenos Ayres, and capitulated in 1814. A sanguinary struggle between the party of independence and the adherents of Spain spread over all the country of the River Plate; but on the 25th March 1816, a new congress of deputies elected by the people was assembled at Tucuman, where Payridon was declared president of the republic; and on the 9th July the separation of the country from Spain was formally declared, and a state of comparative order was re-established. Buenos Ayres was then declared the seat of government. The whole of the viceroyalty did not, however, acknowledge this Government. Bolivia, Paraguay, and Uruguay, established themselves each as a separate republic, after passing through scenes of disorder, whilst the city of Buenos Ayres was itself the scene of sanguinary disturbances. From this time, however, the struggle for independence became, as regards the Argentine Republic, more of a foreign than a domestic war. The combined forces of Buenos Ayres and Chili defeated the Spaniards at Chacabuco in 1817, and at Maypu in 1818; and from Chili the victorious General San Martin led his troops into Peru, where, on the 9th July 1821, he made a triumphal entry into the city of Lima, which had been the greatest stronghold of the Spanish power, having been, from the time of its foundation by Pizarro, the seat of government of the viceroyalty of Peru. A general congress was assembled at Buenos Ayres on the 1st March 1822, in the presence of ambassadors from all the liberated states, and a general amnesty was decreed, though the war was not ended until the 9th December 1824, when the republican forces gained the final victory of Ayacucho, in the Peruvian districts of the Amazon. The Spanish Government did not, however formally acknowledge the independence of the

country until the year 1842. On the 23d January, 1825, a National Constitution for the federal states which form the present Argentine Republic was decreed; and on the 2d February of the same year, Sir Woodbine Parish, acting under the instructions of Mr. Canning, signed a commercial treaty in Buenos Ayres, by which the British Government acknowledged the independence of the country. For details of the history of the country up to the time of independence the reader is referred to the work of Sir Woodbine Parish, and to the *Historia Argentina*, published in Buenos Ayres. These works have been followed in this short narrative, except when otherwise stated, or in unquestionable matters to which they do not allude.

Whilst the events already described were in progress, Buenos Ayres was involved in a war with Brazil, in consequence of the Government of the country having, in 1817, taken possession of the Banda Oriental, which, under the rule of Artigas, had become a scene of anarchy. Buenos Ayres, unassisted by the northern provinces, waged war with Brazil for the possession of the Banda Oriental, until, in the year 1827, by the mediation of England, that country was made independent of both powers. The origin and progress of that war are more connected with the history of the Oriental than with that of the Argentine Republic. Under the new régime, inaugurated as above described in 1825, Rivadavia, who was elected president, endeavored to establish a strong central government; and his party obtained the name of Unitarians in contradistinction to their opponents the Federals, who endeavored to keep each state or province as independent as possible of the National Government. At the expiration of Rivadavia's term of office his opponents triumphed in the election of Vicente Lopez as president; and he was followed in 1827 by Dorrego, another representative of the Federal party. The Unitarians, under the leadership of General Lavalle and his troops, relieved from the war in the Banda Oriental, rebelled against the administration, and in 1828 they defeated the Federals, under Dorrego and General Rosas, in a battle in which Dorrego was taken prisoner and afterwards shot. General Rosas then became chief of the Federal party. In 1829 he defeated Lavalle; and obtaining from Congress, during a "reign of terror," such extraordinary powers as enabled him to rule as dictator, he became as hostile to many members of the Federal party as to the Unitarians. In 1838, a dispute between Rosas and the French Government led to a blockade of the port of Buenos Ayres by the French fleet; and, encouraged by this occurrence, Lavalle, in 1839, returned to the country to rally the Unitarian party. In 1840 he invaded the province of Buenos Ayres at the head of troops raised chiefly in the province of Entre Rios; but he was routed by the Federal army under General Pacheco, and was chased as far as the city of Jujuy, where he was overtaken and shot by troops under the command of Oribe. The rule of Rosas was now one of terror and almost incessant bloodshed in Buenos Ayres, whilst his partisans, General Oribe and Colonel Mazza, endeavored to exterminate the Unitarians throughout the province. This scene of slaughter was extended to the Banda Oriental by the attempt of Oribe, with the support of Rosas, and of Urquiza, governor of Entre Rios, to establish himself as president of that republic, whose existing Government was hostile to Rosas, and sheltered all political refugees from the country under his despotic rule. The siege of Monte Video by the forces of Rosas led to a joint intervention of England and France, and in 1845 the English minister plenipotentiary declared Buenos Ayres blockaded, and determined to establish direct communications with the Republic of Paraguay by ascending the

Parana, the right of navigating which was denied to foreign flags by Rosas, who had always refused to acknowledge the separation of the Government of Paraguay from the authority of Buenos Ayres. At Point Obligado, just above the delta of the river, a severe fight occurred, in which the men of the combined squadrons landed and carried the batteries by storm, after Captain Hope of the "Firebrand" and his crew had succeeded in cutting a heavy iron chain which closed the river under their fire. The allied forces then proceeded to Paraguay, and proclaimed the navigation of the mighty river which forms the highway to that country free to all nations. Ineffectual attempts were made by the allies to induce the people of the River Plate, and more especially Urquiza, to rise against the despotic rule of Rosas; and finding the accomplishment of this impracticable without an army, they withdrew their several forces, and raised the blockade of Buenos Ayres in 1847. Brazil, whose alliance England and France had rejected in consequence of the opposition of that country to the English policy in the suppression of the slave trade, now came to terms with Urquiza; and the forces of Brazil, under Caxias, allied with those raised and commanded by Urquiza, invaded the province of Buenos Ayres, and routed the army of Rosas on the 3d February 1852 at Monte Caseros, about 10 miles from the city. Rosas escaped from the battlefield in disguise, and sought protection at the house of the English *charge d'affaires*, by whom he was conveyed on board H.B.M. steamer "Locust," leaving the city in a delirium of joy at its sudden emancipation from his tyranny. A provisional Government was formed under Urquiza, and the Brazilian and Oriental troops retired. Urquiza then assembled all the provincial governors at San Nicholas, in the province of Buenos Ayres, and on the 31st May they proclaimed a new constitution, with Urquiza as provisional director of the Argentine nation. This constitution gave each province two representatives in the Senate or Upper Chamber of a Congress of Representatives, which was duly elected and met at Santa Fé; but the people of Buenos Ayres, considering that their political and commercial pre-eminence were not duly represented in the Congress, rose in rebellion against it on the 11th September. Alsina then became governor of Buenos Ayres; and in the new civil war which was now inaugurated might be regarded as the representative of the city, which was his chief support, in opposition to the peasantry, who throughout the country districts were chiefly partisans of Urquiza, or of Rosas. Alsina resigned office in face of a rising of the country districts, under Colonel Lagos, in favor of a restoration of Rosas; but Pacheco, who had defeated the Unitarian General Lavalle in 1840, rallied the city party, and with the support of the most influential citizens, proclaimed the aged General Pintos provisional governor, and the influence of the leading members of the foreign community was actively exerted in his favor. The defence of the city, now besieged by Lagos, was entrusted to General Hornos; and Urquiza, having been duly elected president by the other thirteen provinces, came to terms with Lagos, and took command of the army of the besiegers; and in April 1853 his fleet blockaded the port. In July the besiegers suddenly disappeared without awaiting an expected sally of the city forces under General Paz, now commander-in-chief. Urquiza signed, on board H.B.M. steamer "Locust," as representative of the thirteen provinces, a treaty with Sir Charles Hotham, by which the free navigation of the rivers was confirmed. The province of Buenos Ayres then became established as an independent state and inaugurated an era of commercial and political development, with Obligado as constitutional governor, whilst Parana became the capital of the thirteen pro-

vinces under Urquiza. Differential duties imposed by the Confederation for the purpose of preventing the foreign trade of the confederated states from taking its ordinary course through Buenos Ayres caused great irritation in the latter province; but peace was, nevertheless, maintained until 1859, when Alsina again became governor of Buenos Ayres, and the numerous questions in dispute soon led to active hostilities between the Government at Parana and Buenos Ayres. The army of the latter, under General (then Colonel) Mitre, was defeated by the Confederate forces at Cepeda, in the province of Buenos Ayres, in October 1859; and Urquiza re-entered the city, when Alsina resigned his office of governor to Ocampo, and Buenos Ayres rejoined the Confederation, of which Urquiza resigned the presidency. Derqui was then elected president of the fourteen provinces, with the seat of government at Parana; whilst Urquiza became governor of Entre Rios, and Mitre governor of Buenos Ayres. Hostilities, however, recommenced in 1861, and the armies of the opposite parties, under Generals Urquiza and Mitre respectively, met at Pavon, in the province of Santa Fé. Mitre this time was victorious, and in 1862 he was elected president of the Argentine Confederation, of which, with the consent of the provincial Legislature, the city of Buenos Ayres became provisionally the capital. Urquiza retired to the province of Entre Rios, of which he continued to be governor. The history of these struggles is ably told by Mr. Latham from a Buenos Ayrean point of view; and also, from the opposite side, by M. De Moussy, in his able and elaborate work dedicated to Urquiza.

In 1864 the Republic of Paraguay commenced war against Brazil, and on the 5th February 1865, President Lopez sent a despatch to the Argentine Government, requesting permission for the passage of a Paraguayan army through the province of Corrientes. This Mitre refused, the neutrality of the country having previously been declared. On the morning of the 13th April a Paraguayan fleet entered the port of Corrientes, and, without any previous warning of belligerent intentions, fired into and took possession of two vessels of the Argentine navy which were lying at anchor in the port, and also fired on the crew as they endeavored to swim ashore to escape the unexpected slaughter. In the course of the following day a detachment of Paraguayan troops took possession of the city, whilst the main body of an invading army marched across the province, and, crossing the Uruguay, invaded Brazil. The sudden seizure of the vessels in the port of Corrientes was the first notification of war which reached the Argentine Government. The official declaration of war, which was dated the 29th March, and was based on a declaration passed in Congress on the 18th, did not reach the Argentine Government until the 3d May. The people of Buenos Ayres were thrown into a frenzy of indignation on the receipt of the news of the above-mentioned hostilities; and on the 1st May a treaty was signed between the Argentine Government, Brazil, and the Oriental Republic, by which these powers mutually bound themselves not to lay down their arms until they had abolished the Government of Lopez, but at the same time guaranteeing the independence of Paraguay. Thus the National Government established at Buenos Ayres was launched into a war which sorely tried its resources, both for the prosecution of the war itself, and for the suppression of the opponents of its policy in some districts. The war was soon carried into Paraguay; but the withdrawal of the main body of the Argentine army, under Generals Paunero and Arredondo, was necessitated by a rebellion in the north-west (January 1867), where the rebels, under Sae and Videla, had obtained control of several of the

Provincial Governments. The rebel army was not able to cope with the veterans fresh from the battlefields of Paraguay, who drove them across the Andes into Chili, where they laid down their arms. These internal troubles made it requisite for Mitre to retire from the post of commander-in-chief of the allied forces in the field, which then devolved upon the Brazilian General Caxias. Urquiza, though nominally under the order of the National Government, having, on the outbreak of the war accepted from them the appointment of commander-in-chief of the forces of Entre Rios, virtually held that province in a state of neutrality throughout the war, which was ended by the shooting of Lopez on the 1st March 1870, after the extermination of his army and a large majority of the inhabitants of the country. Urquiza, at the outbreak of the war, was the most renowned and powerful chieftain in the country, and doubt regarding the course he might take was a source of anxiety in Buenos Ayres. He had accumulated immense estates and wealth in Entre Rios; and he was doubtless actuated by an earnest desire to preserve to his province the blessings of peace and commercial prosperity in the midst of the surrounding disturbances. The hope of obtaining support from him is, however, supposed to have encouraged the rebellion of the north-western provinces, which neutralised the reckless audacity with which the Argentine troops fought their first battle in Paraguay. In 1868, whilst the war was going on, Mitre's term of office as president expired, and Sarmiento was peacefully elected in his place. The close of the Paraguayan war did not bring permanent peace to the country; for, on the 12th April 1870, Urquiza was assassinated at his family residence by some well-known officers of his army, and the provincial Legislature immediately elected Lopez Jordan as governor in his place. The new governor, in his address to Congress on his installation, took upon himself the responsibility of the assassination, and the National Government refused to acknowledge him as governor of the province, on the ground of undue influence having been brought to bear on the members of the Legislature by which he had been elected. The National troops accordingly invaded the province, for the avowed purpose of affording protection for the free expression of opinion in a new election. This became the commencement of a civil war, which materially interfered with the former prosperity of the province, but which was fortunately brought to a conclusion in the end of January 1873, by the Entre-Riano army being completely routed by the National troops, armed with Remington rifles under Colonel Gainza. The Entre-Riano leader, with about 40 followers, escaped across the Uruguay. Tranquillity has since that time prevailed in Entre Rios.

Whilst these events were in progress, a rupture between the Argentine Republic and Brazil regarding the settlement of the boundaries of Paraguay, was at one time imminent; but, by the influence of Mitre, who went as special envoy to Rio on the occasion, the friendly relation of the two Governments have, it is hoped, been placed on a secure basis.

The prosperity of the country received a temporary check in 1874, from a brief revolution initiated when President Avellanda was declared elected. The unsuccessful party, under Brigadier-General Mitre, incensed at their defeat, asserted that the elections had been gained by corrupt and fraudulent practices, and resolved to appeal to arms to overthrow the president-elect. The revolution was declared on 24th September. President Sarmiento, whose tenure of office was just expiring, took active measures to repress the revolt; and no collision of forces had taken place when the new president, Don Nicolas Avellanda, was constitutionally installed on the

12th October. The president followed up with energy the measures of his predecessor to suppress the revolution, and his efforts were crowned with success in two decisive victories over the insurgents by the Government troops; whereupon Generals Mitre and Arredondo, with their forces, surrendered at discretion, and were made prisoners (Dec. 2). The revolution had lasted but seventy-six days. On the 17th December a state holiday was declared, and dedicated to rejoicings on the restoration of peace. The complete and absolute crushing of this revolution has great significance, as it has brought about the dissolution of a powerful and ambitious party, whose movements might have seriously affected the onward march of the country. Those who know the country believe that it will be long before any similar revolutionary attempts can be made with the slightest hopes of success, or the welfare of one of the most favored countries in the world jeopardised by internal commotion.

The foregoing historical sketch will have given the reader some insight into the government of the country. The framers of the Constitution professed to be guided by that of the United States of North America, and freely adopted the liberal principles there embodied. The president is elected for a term of six years, and the president of the Senate, elected to that office by his fellow-senators, becomes ex-officio vice-president of the republic. The government is conducted by a ministry responsible to Congress, and an adverse vote of the Senate and deputies on any important question leads to the formation of a new ministry. The number of senators and deputies returned by each province is in proportion to the number of its inhabitants. Each province has its own independent form of government for all matters not expressly delegated to the National Government, and is supposed to have irresponsible jurisdiction in its own affairs so long as the articles of the National Constitution are not contravened. The city of Buenos Ayres, besides being the seat of the Government of the province, is also the seat of the National Government, having been so declared by the Constitution, until such time as a suitable site for a new capital for the republic may be determined on by the Legislature. Not only the Constitution itself, but also the spirit in which its enactments are carried out, is thoroughly liberal, and worthy of the magnificent country over which civilisation, under its enlightened regulation, is struggling successfully against barbarism. Fresh arrivals from Europe are not only cordially welcomed, but every effort is made by the authorities to induce foreigners to settle in the country. They are free either to naturalise themselves as Argentines, or to maintain their foreign nationality; in the latter case they have not the privilege of a vote in the government of the country, nor are they liable to the conscription for service in the army. In other respects the law is the same for all. Every one born in the country is by law an Argentine.

The population of the city of Buenos Ayres is almost thoroughly European, nearly one-half being, in fact, foreigners born in Europe. But on passing from that city into the country the Mestizo race becomes more prominent; and in the northern provinces, as in Paraguay and Peru, the Mestisoos, with Indian blood predominating, form the majority of the population. The Negroes, or Mestizoos in whom Negro blood can be traced, do not form an important part of the population as they do in Brazil. The difference between the two countries in this respect is, in fact, very striking. Slavery was abolished during the war of independence; and the importation of Negroes, which had never been an extensive trade, then ceased; and the constant stream

of immigration from Europe, which of late years has been steadily augmenting, is gradually changing the aspect of the population of the country.

The population of the country in 1869 was 1,736,922; in 1882, it was officially estimated at 2,942,000 (less than three to the square mile), of whom 1,907,000 were Argentines, and no fewer than 339,000 of Italian birth; 161,000 Spanish (very many of whom are Basques), 153,000 French; 51,000 English, and 54,000 German and Swiss. The large number of Italians is a conspicuous feature of the population. Much of the increase is due to immigration, nearly 400,000 immigrants having entered the country in the five years, 1881-86; of whom 70 per cent. were Italians, 10 per cent. Spaniards, and 8 per cent. French. In 1901 the population was estimated at 4,794,149.

The total debt of the republic amounts to more than \$490,000,000; and loans have also been negotiated by several of the provinces separately. The budget for 1900 showed an estimated income of \$36,632,346, gold, and \$63,962,000, paper; for some years past the annual expenditure has exceeded the annual revenue. The army and navy are recruited by voluntary enlistment. In 1890, the army strength was 8,720, including a large proportion of officers; and the national guard was returned at 347,653. The navy included three ironclads, six gunboats, eight torpedo-boats, all of good classes, and over twenty other steamers mostly of a small size.

In 1900 the length of railway lines open for traffic was 10,595 miles (extending from Buenos Ayres to Mendoza, with a projected extension across the Andes to meet the Chilean railways, and to Tucuman), and 300 miles more were in course of construction. Above 27,500 miles of telegraph wires stretched through the country, and over them over 5,000,000 messages passed within the year. There are about 1,830 post-offices, and the service, in 1899, carried over 242,000,000 letters and newspapers.

ARGOL, the commercial name under which the crude tartar of commerce is known. It is a semi-crystalline deposit which forms on wine vats, and is either grey or red according to the color of the wine from which it separates.

ARGONAUTS, in *Greek Legend*, a band of heroes who sailed in the ship "Argo" from Iolcus, in Thessaly, to Æea, in Colchis, on the further shore of the Black Sea, to fetch the golden fleece, which was there guarded by a dragon in a grove sacred to Mars. This task had been imposed on Jason that he might prove himself by a perilous adventure worthy of the throne of Iolcus, which he claimed from the usurper Pelias, at whose hands he and his father Æson had suffered persecution. To accompany him, Jason, when the "Argo" was ready, called upon the principal heroes of his own race, the Minyæ, whose distant voyages and colonisation in very early times seemed to have suggested the legend of this expedition. Of these Acastus the son of Pelias, Admetus, of Phœræ, Euphemus (represented as connected with the colonisation of Thera and Cyrene), Periclymenus, Erginus, and Tiphys the steersman, joined him. So far the crew appears well fitted to conduct the "Argo" to Colchis, leaving Jason to reserve his strength for the culminating act, in which also they had mostly, apart from their friendship for Jason, a special interest, because of previous events connected with the golden fleece, the story of which was as follows. Jason's uncle Athamas had by his wife Nephele two children, Phrixus and Helle. The mother died and her place was taken by Ino, a daughter of Cadmus, who from hatred of her step-children persuaded Athamas, by means of a false oracle, to offer his son Phrixus as a

sacrifice, in consequence of a famine which she had caused by having the grain secretly roasted before it was sown. But before the sacrifice the shade of Nephele appeared to Phrixus, bringing a ram with a golden fleece, on which he and his sister Helle were to escape over the sea. Helle fell off and drowned in the strait, which thence took the name of Hellespont. Phrixus reached the other side, and proceeding on land to Colchis, sacrificed the ram, and hung up its fleece in the grove of Mars. With the family of Athamas the original crew of the "Argo" were more or less connected. But in the later versions of the story it is clear that such a voyage could not in after times be conceived without a variety of adventures, for which other and better known heroes had to be added. Of these the chief were Hercules, Castor and Pollux, Orpheus, Mopsus, and the sons of Boreas, Calais and Zetes. The outward course of the "Argo" was the same as that of the Greek traders, whose settlements as early as the 6th century B.C. dotted the southern shore of the Black Sea. The first landing-place was Lemnus, which the Argonauts found occupied only by women who, at the instigation of Aphrodite, had slain their husbands, fathers, &c. Here some stay was made, and Hypsipyle bore Jason a son, Euneos, who afterwards traded with the Greeks before Troy and with the Phœnicians. That the Minyæ had at a very early period formed settlements in Lemnus is known from Herodotus (iv. 145). They landed at Cyzicus next, and here occurred the incident of Hercules and Hylas. The former having broken an oar after they started, went into the wood to cut a new one, Hylas accompanying him to fetch water. Some nymphs admiring the beauty of the youth carried him off. Hercules followed his cries, but could not find him. Nor was he ever found, though the hero exacted hostages till this should be done. On reaching the modern Scutari, they again landed to get water, and were challenged by the king, Amycus, to match him with a boxer. Pollux came forward, and in the end overpowered his adversary, and bound him to a tree. At the entrance to the Black Sea they met Phineus, the blind and aged king whose food was being constantly polluted by the Harpies. He knew the course to Colchis, and offered to tell it, if the Argonauts would free him from the Harpies. This was done by the winged sons of Boreas, and Phineus now told them their course, and that the way to pass through the Symplegades—two cliffs which moved on their bases and crushed whatever sought to pass—was first to fly a pigeon through, and when the cliffs, having closed on the pigeon, began to retire to each side, to row the "Argo" swiftly through. His advice was successfully followed. The next place they landed at, and the last before reaching Colchis, was Heraclea, where the steersman Tiphys died. To the early Greeks Colchis was the eastern extremity of the earth, as the Pillars of Hercules were the western. Behind both was the Oceanus, into which the river Phasis flowed at Colchis. At Colchis was the rising of the sun, and Æetes the king was a son of Helios; while his daughter Medea was, by her knowledge of witchcraft, connected with the worship of the moon. Æetes required of Jason that he should first yoke to a plough his bulls which snorted fire and had hoofs of brass, and with them plough the field of Mars. That done, the field was to be sown with dragons' teeth, from which armed men were to spring. Successful so far by means of the mixture which Medea had given him as proof against fire and sword, Jason was next allowed to approach the dragon which watched the fleece; Medea soothed the dragon with another mixture, and Jason became master of the fleece. The

the voyage homeward began. Medea accompanying Jason, and Æetes pursuing them. To delay him and obtain escape, Medea dismembered her young brother Absyrtus, whom she had taken with her, and cast the limbs about in the sea for his father to pick up. In another report Absyrtus had grown to manhood then, and met his death in an encounter with Jason, in pursuit of whom he had been sent. Of the homeward course various accounts are given. In the oldest existing account, the "Argo" sailed along the river Phasis into the Oceanus, thence to the mythical lake Tritonis, after being carried twelve days over land through Libya, and thence again to Iolcus. Hecataeus of Miletus suggested that from the Oceanus it may have sailed into the Nile, and so to the Mediterranean. Others, like Sophocles, described the return voyage as differing from the outward course only in taking the northern instead of the southern shore of the Black Sea. Some supposed that the Argonauts had sailed up the river Tanais, passed into another river, and by it reached the North Sea, returning to the Mediterranean by the Straits of Gibraltar. And again, others laid down the course as up the Danube (Istros), from it into the Adriatic by a supposed mouth of that river, and on to Corcyra, where a storm overtook them. Next they sailed up the Eridanus into the Rhodanus, passing through the country of the Celts and Ligurians, and reaching the Tyrrhenian Sea and the island of Circe, who absolved them from the murder of Absyrtus. Then they passed safely through Scylla and Charybdis, past the Sirens, through the Planctæ, over the island of the Sun, Trinacria, and on to Corcyra again, the land of the Phæacians, where Jason and Medea held their nuptials. They had sighted the coast of the Peloponnesus when a storm overtook them and drove them to the coast of Libya, where they were saved from a quicksand by the local nymphs. The "Argo" was now carried twelve days and twelve nights to the Hesperides, and thence to lake Tritonis, whence Triton conducted them to the Mediterranean. At Crete the brazen Talos, who would not permit them to land, was killed by the Dioscuri. At Anaphe they were saved from a storm by Apollo. Finally they reached Iolcus, and the "Argo" was placed in a grove sacred to Neptune on the isthmus of Corinth. Jason's death, it is said, was afterwards caused by part of the stern giving way and falling upon him.

ARGONNE, a rocky and forest-clad plateau in the north-east of France, extending along the borders of Lorraine and Champagne, and forming part of the departments of Ardennes and Meuse. The famous defense of the French frontier by Dumouriez in 1792 is called the Argonne campaign.

ARGOS. The most important city of this name was situated in the eastern part of the Peloponnesus, about 3 miles from the sea. By the Greeks themselves it was regarded as the most ancient of all their cities, and as the local habitation of many of their earlier heroes. Here Inachus and his descendants had reigned for many generations, until the arrival of Danaus the Egyptian, with his fifty daughters, whose dynasty, glorious with the names of Perseus the Gorgon-slayer, and Eurystheus the master of Hercules, held sway over Argos, and Tiryns, and Mycenæ, till it, in its turn, was succeeded by the still more important dynasty of Pelops. The Dorian invasion and conquest followed, and Argos became the head of a Dorian confederation, extending its authority over a large portion of the neighboring territory. Between this region (Argolis) and Sparta, however, there were no natural boundaries, and a conflict arose between the two states about the border land of Cynuria. For a time, under the despotic management of Phcidon,

Argos maintained its ground; but Sparta ultimately established its claim in spite of the dubious result of the famous duel of the 600, which was fought for the decision of the dispute, and the strength of the Argives was completely crushed by Cleomenes at the battle of Tiryns. A temporary ascendancy of the serfs in Argos, an extension of the franchise, and a permanent adoption of a more democratic constitution, seem to have been the consequences of this national exhaustion and the subsequent reaction. During the Persian war Argos was indifferent and neutral, but in the contest for power which ensued between Athens and Sparta, the old antipathy against the latter was sufficient to make the Argives staunch allies of the former. In the 4th century B.C., the democratic constitution of the city degenerated into a reign of terror, which in its turn gave place to a series of tyrannies, from which escape was ultimately found in the Achæan League and the Roman domination. Pyrrhus perished in an unsuccessful attack on the city in 272 B. C. In the 13th century of our era, Argos fell into the possession of the Franks, from whom it passed into the hands of the Byzantine despots; and in 1463 it was taken by the Ottoman troops. Here in the darkest period of Greek ignorance lived one of the few representatives of the ancient learning, Theodosius Zigomali (Crusius's *Turcogræcia*). In the time of Pausanias the number of temples in Argos and its neighborhood was remarkable, the most important of them being the Heræum, or temple of Hera, the ruins of which, visible from the acropolis of Argos, but nearer to Mycenæ, were discovered in 1831 by Colonel Gordon of Ceirass.

ARGOSTOLI, the capital of Cephalonia, one of the Ionian islands, and the seat of a bishop of the Greek Church.

ARGOVIE (Lat. *Argovia*), the French form of Aargau, the name of one of the Swiss cantons. See **AARGAU**.

ARGUIN, an island, perhaps Hanno's *Cerne*, off the west coast of Africa.

ARGUS, in *Greek Legend*, the son of Agenor or Arestor, or, according to others, an earth-born hero (Autochthon). He was called Panoptes, All-seeing, from having a hundred eyes. After performing several feats of valor, he was appointed by Juno to watch the cow into which Io had been transformed. While doing this he was slain by Mercury, who, according to one account, stoned him to death, according to another, put him to sleep by playing on the flute, and then cut off his head. His eyes were transferred by Juno to the tail of the peacock.

ARGYLL, EARLS AND DUKES OF. The rise of this family of Scottish peers, originally the Campbells of Lochow, first ennobled as Barons Campbell, and still retaining the family name Campbell, is referred to in the article **ARGYLLSHIRE** (*q.v.*)

ARGYLLSHIRE, or **ARGYLESHERE**, a county on the west coast of Scotland, comprehending a large district on the mainland and a number of the Hebrides or Western Isles. The mainland portion is bounded on the N. by Inverness-shire; on the E. by the counties of Perth and Dumbarton, Loch Long, and the Firth of Clyde; on the S. by the North Channel; and on the W. by the Atlantic. Its sea coast has been stated at over 600 miles. If the various islands are included, the greatest breadth of the county is 68 miles, and its total area amounts to 3255 square miles, or 2,083,126 acres, which is more than a tenth part of the whole area of Scotland. It contains forty parishes, and has been variously divided at different times into a number of districts. The names of these at present in use are North and South Argyll, Cowal, Dunoon, Kintyre (or

Cantyre), Tarbert, Lorn, Mull, Ardnamurchan, Morven, Islay, &c. The principal towns are Inverary, Dunoon, Campbelltown, Oban, and Tobermory.

There are numerous mountain streams, but no navigable rivers. The two principal are the Orchy and Awe. The former flows from Loch Tulla through Glen Orchy, and falls into Loch Awe at its northern extremity; and the latter forms an outlet for the loch across the neck of land which lies between it and Loch Etive. The other streams are the Add, Aray, Coe or Cona, Creran, Douglas, Echaig, Etive, Euchar, Feochan, Finart, Fyne, Kinglas, Kinloss, Large, Leven, Nell, Ruel, Shiel, Shira, Strac, Talaken, Uisge-Dhu, &c. Most of these yield excellent salmon and trout fishing. There are also some good fishing streams in the islands. The county is remarkable for the numerous inlets of the sea with which it is deeply indented, the principal of them being Loch Long, with its branch Loch Goil; Loch Fyne, with Loch Gilp; Loch Etive; Loch Linnhe, with its branches Loch Creran, Loch Leven, and Loch Eil; and Loch Sunart. There is also a large number of inland lakes, the total area of which is about 25,000 acres. Of these the principal are Loch Awe, Loch Avich, Loch Eck, Loch Lyndoch (partly in Perthshire), and Loch Shiel.

The principal islands are Mull, Islay, Jura, Colonsay, Lismore, Tiree, Coll, Gigha, Muck, Rum, and Canna. Besides these there are the two small but interesting islands of Staffa and Iona—the one famous for its basaltic caves and rocks, and the other as the earliest seat of Christianity in Scotland.

The whole county is rugged and mountainous, and many of the peaks are among the loftiest in the kingdom; as Ben Cruachan (3689 ft.), Ben More, in Mull (3172), Ben Ima (3318), Buchael Etive (3345), and Ben Arthur, "The Cobbler" (2891), on the borders of Dumbartonshire. To the tourist it offers a rich variety of Highland scenery, culminating in the gloomy grandeur of Glencoe.

The earliest recorded event in the history of Argyllshire is the settlement in the 4th or 5th century of a body of Irish Scots, under the leadership of Erc, who soon extended their power and established a dynasty. The most famous of their kings was Aidan, the friend of Columba. In the 8th century the district fell into the hands of Norwegian adventurers, and continued for five or six hundred years under Norwegian control, till the rise of a deliverer called Somerlid. Along with the Hebridean Isles, all the western parts of Argyll came to the Scottish monarchs by conquest in the fourteenth century. Some time after, Macdonald, the representative of this region, obtained leave from the Scottish crown to hold his possessions as a feudatory to that kingdom; but his turbulent spirit involved him and his family in repeated rebellions. These were at last punished by the forfeiture of the estates, which, along with the titles, were bestowed on the Campbells of Lochoy, who have ever since retained them. Colin, second Lord Campbell, was created earl of Argyll in 1457; Archibald, second earl, fell at Flodden; Archibald, fourth earl, was the first nobleman in Scotland who declared himself a Protestant; Archibald, fifth earl, is famous as the supporter of Queen Mary; Archibald, the eighth earl, and other prominent holders of titles, were much noted in Scottish history. The tenth earl was raised to the dukedom of Argyll in 1701. The title is now (1890) held by a member of the same family, George Douglas Campbell, eighth duke.

Like other parts of the Highlands of Scotland, this county was the seat of several clans, of which the principal were the Campbells, the Macleans, the Stewarts of Appin, the Macdonalds of Glencoe, the Macquarries,

and the Macdougalls; and the number of Campbells is still a striking feature of the personal nomenclature of the county. Gaelic is still to a considerable extent the vernacular dialect. The chief proprietors are the duke of Argyll and earl of Breadalbane, whose estates are respectively 168,000 and 179,000 acres in extent. The other principal estates, according to extent, are those of Poltalloch (183,000 acres), Islay (67,000), Jura (55,000), Ardnamurchan (55,000), Sunart (54,418), Kildalton (54,250), and Ardkinglass (51,670). The number of owners of land possessing one acre or upward was in 1872-73, 581, and of owners who had less than one acre, 2,283. Population (1889), 74,220.

ARGYRO-CASTRO (*Ergir Castri*), a town in the valley of the Drino, in the province of the Avlona, in Albania (*Epirus*). It has been variously identified with Hadrianopolis and Antigonea, and is supposed to preserve the name of the ancient Argyrini. It is the focus of the Mussulman aristocracy of Epirus.

ARGYROPULUS, or ARGYROPULO, JOHN, a learned Greek, who lived during the fifteenth century.

ARIA (Ital. *air*), in music, a rhythmical melody, as distinct from recitative. The term was formerly applied to a measured lyrical piece either for one or several voices; but is now commonly applied to a song introduced in a cantata, oratorio, or opera, and intended for one voice supported by instruments. ARIETTA is a short melody.

ARIADNE, a personification of the return of Spring, at which period took place, it was believed, Ariadne's marriage with Dionysos (Bacchus), who also, after an absence throughout the winter, was thought to return amid the rejoicings of spring. This marriage was the great feature in her worship, which appears to have originated in Crete, and to have been mostly confined to that island and to Naxos, where annually it was celebrated by the people with dances and a festival called *Theadaisia*. But though married to Dionysos, she did not generally appear in this character. On the contrary, in the *Odyssey*, it is said that Artemis slew her, with the consent of Dionysos, at Dia, before she could reach Athens with Theseus. Her death would seem a punishment for her infidelity.

ARIANO, a town of Italy, in the province of Avelino, about 38 miles N.E. of Naples, situated 2500 feet above the level of the sea, on a steep and rocky hill, between the rivers Calore and Tribaldo. Founded by the Greek governors of Apulia, it continued to be an important military post for several centuries, and was frequently taken and retaken during the various dynastic struggles of southern Italy. A parliament was held here by Roger I. in 1140, and in 1648 the town was pillaged by the duke of Guise. It is still a bishop's see, and the chief town of a *circondario*, with a cathedral, and a large number of churches. Earthenware is manufactured, and there is some trade in wine and butter. The most peculiar feature of the town is the multitude of troglodytic dwellings, in which the poorer classes reside. The district is highly volcanic, and the town has suffered severely from earthquakes (1456, 1732), and only 7 miles distant is the lake of Amsancus (*Mofete*), remarkable for its suffocating exhalations. Population, 14,347. (See Vitale, *Storia della Città d'Ariano*, Rome, 1794.)

ARIANS. See ARIUS.

ARIAS MONTANUS, BENEDICTUS, one of the most learned Oriental scholars of his time, and the editor of the Antwerp Polyglott, was born at Frescal de la Sierra, in Estremadura, in 1527. After studying at the university of Alcalá, he joined the Benedictine order. In 1562 he accompanied the bishop of Segovia to the Council of Trent. After a few years spent in retire-

ment at Arcena he went to Antwerp, at the request of Philip II., to edit the Polyglott Bible that had been projected by Plantin the printer. The work appeared in 8 volumes folio, between 1568 and 1573. The Jesuits founded on it several charges of heresy against Arias, from which he succeeded in clearing himself, though only after several visits to Rome. He declined the offer of a bishopric from the king, but after some time spent in retirement at Aracena, became librarian at the Escorial. The closing years of his life were passed at Seville, where he died in 1598.

ARICA, a sea-port of Peru, in the department of Moquegua. It was at one time a city of 30,000 inhabitants, and had a large export trade in wool, copper, and silver; but in consequence of civil war (1821) and earthquakes (1832, 1868), it has greatly declined; of late, however, it has shared in the general revival of Peru.

ARIEGE, a department of France, bounded on the S. by Spain, W. by Haute-Garonne, N. E. by Aude, and S. E. by Pyrénées Orientales. It embraces the old countship of Foix, and a portion of Languedoc and Gascony, and has an area of 1889 square miles. The southern part is occupied by the Pyrenees, which here contain some of the highest peaks in France; as, Pic d'Estats (which is 10,811 feet above the level of the sea), Montcalm (10,512), Fodtargentine, and Montleon. Among the celebrated men of the department are Gaston de Foix, Pope Benedict XII., and Pierre Bayle. The chief town is Foix; the arrondissements, Foix, St. Girons, and Pamiers. Population, (1901), 202,284.

ARION (pronounced *Ari'on*), a celebrated poet and cithara player, a native of Methymna, in Lesbos. As he is said to have been the friend of Periander, tyrant of Corinth, he must have flourished about 625 B.C. Nothing more is known of the life of Arion, with the exception of the beautiful story first told by Herodotus, and afterwards elaborated and embellished by many subsequent writers. According to Herodotus, Arion had become desirous of exhibiting his skill in foreign countries, and, leaving Corinth, had travelled through Sicily and parts of Italy, where he gained great fame, and amassed a large sum of money. At Tarentum he embarked for his homeward voyage in a ship belonging to Corinth. The sight of his treasure roused the cupidity of the sailors, who resolved to possess themselves of it by putting him to death. In answer to his entreaties that they would spare his life, they insisted that he should either die by his own hand on shipboard, or cast himself into the sea. Arion chose the latter, and as a last favor begged permission to sing a parting song. The sailors, desirous of hearing so famous a musician, consented, and the poet, standing on the deck of the ship, arrayed in the rich garments in which he was accustomed to be habited, sang a dirge accompanied by his lyre. He then threw himself overboard; but instead of perishing, as the sailors imagined, he was miraculously borne up in safety by a dolphin, supposed to have been charmed by the music. Thus he was conveyed to Tænarus, whence he proceeded to Corinth, arriving before the ship from Tarentum. Immediately on his arrival Arion related his story to Periander, the tyrant of Cérinth, who was at first incredulous, but eventually learned the truth by a stratagem. Summoning the sailors, he demanded what had become of the poet. They affirmed that he had remained behind at Tarentum; upon which they were suddenly confronted by Arion himself, arrayed in the same garments in which he had leapt overboard.

ARIOSTO, LODOVICO, one of the greatest poets of Italy, was born at Reggio, in Lombardy, on the 8th Sept. 1474. His father was Niccolò Ariosto, com-

mander of the citadel of Reggio. He showed a strong inclination to poetry from his earliest years, but was obliged by his father to study the law—a pursuit in which he lost five of the best years of his life. Allowed at last to follow his inclination, he applied himself to the study of the classics under Gregorio da Spoleti. But after a short time, during which he read the best Latin authors, he was deprived of his teacher by Gregorio's removal to France as tutor of Prince Sforza. Ariosto thus lost the opportunity of learning Greek, as he intended. His father dying soon after, he was compelled to forego his literary occupations to undertake the management of the family, whose affairs were embarrassed, and to provide for his nine brothers and sisters, one of whom was a cripple. He wrote, however, about this time some comedies in prose and a few lyrical pieces. Some of these attracted the notice of the cardinal Ippolito of Este, who took the young poet under his patronage, and appointed him one of the gentlemen of his household. This prince usurped the character of a patron of literature, whilst the only reward which the poet received for having dedicated to him the *Orlando Furioso*, was the question, "Where did you find so many stories, Master Ludovic?" The poet himself tells us that the cardinal was ungrateful; deplores the time which he spent under his yoke; and adds, that if he received some niggardly pension, it was not to reward him for his poetry, which the prelate despised, but to make some just compensation for the poet's running like a messenger, with risk of his life, at his eminence's pleasure. Nor was even this miserable pittance regularly paid during the period that the poet enjoyed it. The cardinal went to Hungary in 1518, and wished Ariosto to accompany him. The poet excused himself, pleading ill health, his love of study, the care of his private affairs, and the age of his mother, whom it would have been disgraceful to leave. His excuses were not received, and even an interview was denied him. Ariosto then boldly said, that if his eminence thought to have bought a slave by assigning him the scanty pension of 75 crowns a year, he was mistaken and might withdraw his boon—which it seems the cardinal did.

The cardinal's brother, Alphonso, duke of Ferrara, now took the poet under his patronage. This was but an act of simple justice, Ariosto having already distinguished himself as a diplomatist, chiefly on the occasion of two visits to Rome as ambassador to Pope Julius II. The fatigue of one of these hurried journeys brought on a complaint from which he never recovered; and on his second mission he was nearly killed by order of the violent Pope, who happened at the time to be much incensed against the duke of Ferrara. On account of the war, his salary of only 84 crowns a year was suspended, and it was withdrawn altogether after the peace; in consequence of which Ariosto asked the duke either to provide for him, or to allow him to seek employment elsewhere. A province, situated on the wildest heights of the Apennines, being then without a governor, Ariosto received the appointment, which he held for three years. The office was no sinecure. The province was distracted by factions and banditti, the governor had not the requisite means to enforce his authority, and the duke did little to support his ministry. Yet it is said that Ariosto's government satisfied both the sovereign and the people confided to his care; and a story is added of his having, when walking out alone, fallen in with a party of banditti, whose chief on discovering that his captive was the author of *Orlando Furioso*, humbly apologised for not having immediately shown him the respect which was due to his rank. Although he had little reason to be satisfied with his office, he

refused an embassy to Pope Clement VII. offered to him by the secretary of the duke, and spent the remainder of his life at Ferrara, writing comedies, superintending their performance, as well as the construction of a theatre, and correcting his *Orlando Furioso*, of which the complete edition was published only a year before his death. He died of consumption on the 6th of June, 1533.

Of all the works of Ariosto, the most solid monument of his fame is the *Orlando Furioso*, the extraordinary merits of which have cast into oblivion the numberless romance poems which inundated Italy during the 15th, 16th and 17th centuries.

ARISTÆUS (from ἀρίστος, best, a divinity whose worship was widely spread throughout Greece, but concerning whose origin and career the myths are somewhat obscure. The account most generally received connects him specially with Thessaly. Apollo carried off from Mount Pelion the nymph Cyrene, daughter or granddaughter of Peneus (Peneius), and conveyed her to Libya, where she gave birth to Aristæus. From this circumstance the town of Cyrene took its name. The child was at first handed over to the care of the Hours; or, according to another version, to the nymph Melissa and the centaur Chiron. He afterwards left Libya and came to Thebes, where he received instruction from the Muses in the arts of healing and prophecy, and married Autonoe, daughter of Cadmus, by whom he had several children, among others, the unfortunate Actæon. He is said to have visited Ceos, where by erecting a temple to Zeus Icmæus (the giver of moisture), he freed the inhabitants from a terrible drought. The islanders worshipped him, and occasionally identified him with Zeus, calling him Zeus Aristæus.

ARISTANDER, the favorite soothsayer of Alexander the Great, who consulted him on all occasions. After the death of the monarch, when his body had lain unburied for thirty days, Aristander procured its burial by foretelling that the country in which it was interred would be the most prosperous in the world. He is probably the author of a work on prodigies, which is referred to by Pliny and Lucian.

ARISTARCHUS, of Samothrace, the most famous of the Greek grammarians and critics, flourished about 160 B.C. He spent the greater part of his life at Alexandria, where he studied in the school of Aristophanes of Byzantium. He acquired the highest reputation for critical skill, and founded a school for philology, which long flourished at Alexandria and afterwards at Rome. Ptolemy V. (Epiphanes) and Ptolemy VII. (Physcon), are said to have been among his pupils.

ARISTARCHUS, a Greek astronomer of Samos, who lived about 280–264 B.C. He is famous as being the first to maintain that the earth moves round the sun. No mention, indeed is made of this doctrine in his only surviving work, which treats of the *Magnitudes and Distances of the Sun and Moon*; but Archimedes, in his *Arenarius*, quotes from a work written by Aristarchus as a refutation of astrology, which renders it certain that the Samian astronomer had clearly anticipated the grand discovery of Copernicus.

ARISTEAS, a somewhat mythical personage, said to have been a native of Proconnesus, an island in the Propontis.

ARISTIDES, surnamed the Just, was the son of Lysimachus, a native of Athens, of the tribe Antiochis. His family appears to have been of noble descent; at least it is known that Callias, the torch-bearer at the Eleusinian mysteries, and reputedly the wealthiest man in Athens, was a cousin or near kinsman. Plutarch maintains, in opposition to Demetrius Phalereus, that Aristides was very poor, and never enriched himself at

the expense of the state. His poverty, however, seems scarcely reconcilable with the fact that he was made archon at a time when the possession of a certain amount of property was an indispensable qualification for that office.

The first certain appearance of Aristides in history was at the battle of Marathon, 490 B.C., where he was one of the ten generals, and led his own tribe, Antiochis. He is said to have been second in command to Miltiades. According to custom each of the ten generals had supreme command of the whole army for one day; Aristides saw the disadvantages of this system, which totally prevented any fixed plan being carried out, and by his advice and example prevailed on the other generals to relinquish their right in favor of Miltiades. This prudent measure contributed largely to the success of the battle, in which also, according to Plutarch, much was due to the valor of Aristides. He was left with one tribe to collect the spoil from the field of battle, while Miltiades marched to Athens to protect the city from the Persian fleet. He discharged the duty intrusted to him with the most scrupulous honesty. Next year he was made archon eponymus, and his reputation for justice appears to have been increased by the manner in which he performed the duties of his office. But his great rival, Themistocles, who had been meanwhile increasing his own power, grew jealous, and gradually raised a strong feeling against him by representing how dangerous it was for a democracy that any individual should be allowed to gain such influence as that of Aristides. The Athenians, uneasy at this idea, banished him by ostracism in 483. It is said that, on this occasion, an ignorant fellow, who did not know Aristides, came up to him, and giving him his shell, desired him to write upon it the name of Aristides. The latter asked in surprise if Aristides had done him any wrong. "No," was the reply, "and I do not even know him, but it irritates me to hear him everywhere called the just." Aristides made no answer, but took the shell and wrote his own name on it.

On the night before the battle of Salamis, Aristides, who was still in exile, made a perilous journey through the enemy's fleet, and reached the tent of Themistocles. He told him that he had come to bury in oblivion their former differences; that he had learned his plan for giving battle to the Persian fleet in the narrow straits of Salamis, and highly approved of it; and that he would assist him to the utmost of his ability. By his influence the other generals were induced to assent to the plans of Themistocles, of whom they were somewhat jealous. On the day of battle, Aristides collected some Athenian volunteers, and made a descent on the little island of Psyttalea, which was filled with the forces of the enemy. These he routed and almost annihilated. After the victory of Salamis he dissuaded Themistocles from his ambitious plan of conquering Asia by destroying the bridge which the Persians had built over the Hellespont, and thereby cutting off their communications.

About this time his sentence of exile appears to have been revoked, for in 479 he was general of the Athenians in the campaign against Mardonius, and shared with Pausanias the glory of the victory at Plataea. By his prudent counsels before the battle, he settled a dangerous dispute with the Tegetæ; and after the victory, when the Athenians and Lacedæmonians were contending as to the right of erecting the trophy, he prevailed on the Athenians to give up their claim. The Lacedæmonians immediately followed this example, and the honors of the day were given to the Plataeans. He also instituted yearly sacrifices and quinquennial games at Plataea, to celebrate the victory over the barbarians and

the liberation of Greece. On his return to Athens Aristides introduced the famous measure by which the archonship was thrown open to all classes of citizens. In 477, he was sent along with Cimon, over whom he had great influence, to take command of the Athenian contingent, under the general command of Pausanias the Lacedæmonian. The haughtiness and oppressive conduct of the Spartans had disgusted the allies, who were completely won over by the mildness and prudence of Aristides and Cimon. In a body the allied Greeks threw off the hegemony of Sparta, and formed a confederation under the Athenians. To Aristides was committed the task of drawing up the laws for this confederacy, and settling the amount of tribute which should be paid by each state. This duty he discharged to the complete satisfaction of the allies, who were delighted to be assessed at only 460 talents. The first instalment of the tax was paid into the national treasury, then situated on the sacred island of Delos, but afterwards transferred to Athens, a measure which Aristides is said to have declared unjust but expedient.

The time and place of his death are uncertain. It is known, at least, that he survived the banishment of Themistocles, for his generous conduct towards his fallen rival is commemorated by Plutarch. He died, probably, about 468 B.C., according to some at Athens, according to others at Pontus. He is said to have died in such poverty that he did not leave enough to defray his funeral expenses, but had a tomb erected to him with funds from the public treasury. This tomb at Phalerum was still to be seen in the time of Plutarch. His daughters received marriage portions from the state, and his son, Lysimachus, was granted a sum of money and a portion of land. Such was the respect of the Athenians for the memory of their great statesman, that even his remote descendants are said to have received assistance from the public treasury.

ARISTIDES, ÆLIUS, surnamed Theodorus, a distinguished Greek rhetorician or sophist, was the son of Eudæmon, a priest of Zeus, and was born at Adriani, in Mysia. The date of his birth is given by some as 129 A.D., by others, with more probability, as 117. Died in 189 A.D. His account of different cures has excited considerable attention, from the similarity between them and the effects produced by Mesmerism or Hypnotism, *i. e.*, nervous sleep.

ARISTIDES of THEBES, a celebrated Greek painter, was an older contemporary of Apelles, and flourished about 350 B.C. He is said by Pliny to have been the first to express in his paintings character and passion; but this is probably an exaggeration. Several of his paintings are recorded in which there was manifested extraordinary mastery of expression. His coloring is said by Pliny to have been hard.

ARISTIDES, QUINTILIANUS, author of a valuable treatise on music, lived probably in the first century of our era. According to Meibomius, in whose collection (*Antiq. Musicæ Auc. Septem*, 1652) this work is printed, it contains everything on music that is to be found in antiquity.

ARISTIPPUS, the founder of the Cyrenaic school of philosophy, was the son of Aritadas, a wealthy merchant of Cyrene, in Africa. He proceeded to Athens, united himself to the circle of followers who surrounded Socrates, and continued with him till his death in 399. He did not, however, accept without essential modification the teaching of his master, and his conduct, in many points, was displeasing both to Socrates and to other members of the Socratic band. He had probably brought with him from the wealthy city of Cyrene habits of luxury and ostentation, which contrasted forcibly with the homely and temperate life of his master.

Xenophon, in the *Memorabilia*, reports his conversation on the nature of temperance, in which he defends his life of ease and self-indulgence. Plato also somewhat significantly states that he was absent in the island of Ægina on the day when Socrates died. Another feature of his character, which rendered Aristippus objectionable to the other Socratics, was his tendency to adopt the theory and practice of the Sophists, among whom he is expressly included by Aristotle. It is more than probable that in Cyrene he had been already introduced to the doctrines of Protagoras, of whose influence his own theory shows manifest traces. We are further told that he opened his school before the death of Socrates, who blamed him for receiving payment from his scholars. This story is probably inaccurate as to the time when he began to teach, but it is undoubtedly true that he took money for his lectures, and defended the practice. Aristippus resembled the Sophists in another particular; like them, he avoided the duties and ties of citizenship by wandering from city to city. He was a professed cosmopolitan. The records of his travels, particularly of his visit or visits to the court of Syracuse, and his hostile relations with Plato there, are not in all points consistent, and rest on but slender authority. He appears to have settled finally in his native city, and seems to have died there. Although nothing is known with certainty as to the dates of his birth and death, 435 B.C. for the one, and about 356 B.C. for the other, may be accepted as probably accurate. The life of Aristippus is the best exemplification of his principles. True temperance, according to him, consists not in abstaining from pleasure, but in being able to enjoy it with moderation. He therefore indulged in good living, rich clothing, splendid dwellings, and in the society of the accomplished heteræ. But in all these pleasures he remained thoroughly master of himself; he possessed them, and was not possessed by them. At any moment he could relinquish pleasure, for he had attained an equanimity that rendered him happy under any circumstances. To make the most of life, reasonably to enjoy the present moment, and to drive off care, reflection, and forethought, were the practical precepts by which he guided himself. As might naturally be expected, Aristippus left no definite system of philosophy; indeed, according to some accounts, he wrote nothing at all.

ARISTO, or ARISTON, of Chios, a Stoic philosopher and pupil of Zeno, flourished about 250 B.C. He differed from Zeno in many points, and approximated more closely to the Cynic school. He was very eloquent (and was therefore called the Sirene), but was controversial in tone.

ARISTOBULUS of CASSANDRIA, one of the generals who accompanied Alexander the Great, and who afterwards, when very aged, wrote a history of the expedition. This work was much used by Arrian, who praises it highly. Only a few fragments remain, these are given in Müller's *Hist. Græc. Frag.*

ARISTOBULUS, a Jew of Alexandria, and a philosopher of the peripatetic school, flourished about 160 B.C., in the reign of Ptolemy Philometer. He is the first representative of the Jewish-Alexandrian philosophy, the aim of which was to reconcile and identify Greek philosophical conceptions with the Jewish religion.

ARISTOPHANES. The birth-year of Aristophanes is uncertain. He is known to have been about the same age as Eupolis, and is said to have been "almost a boy" when his first comedy was brought out in 427 B.C. The most probable conjecture places his birth in or about the year 448 B.C. His father Philippus was a landowner in Ægina. Aristophanes was an Athenian

citizen of the tribe of Pandionis, and the deme Cydathenê. The stories which made him a native of Cameirus in Rhodes, or of the Egyptian Naucratis, had probably no other foundation than an indictment for usurpation of civic rights which appears to have been more than once laid against him by Cleon. His three sons—Philippus, Arârôs, and Nicostratus—were all comic poets. Philippus, the eldest, was a rival of Eubulus, who began to exhibit in 376 B.C. Arârôs brought out two of his father's latest comedies,—the *Côcalus* and the *Æolosicôn*, and in 375 began to exhibit works of his own. Nicostratus, the youngest, is assigned by Athenæus to the Middle Comedy, but belongs, as is shown by some of the names and characters of his pieces, to the New Comedy also.

Although tragedy and comedy had their common origin in the festivals of Dionysus, the regular establishment of tragedy at Athens preceded by half a century that of comedy. The Old Comedy may be said to have lasted about 80 years (470–390 B.C.), and to have flourished about 56 (460–404 B.C.). Of the forty poets who are named as having illustrated it the chief were Cratinus, Eupolis, and Aristophanes. The Middle Comedy covers a period of about 70 years (390–320 B.C.), its chief poets being Antiphanes, Alexis, Plato Comicus, Theopompus, and Strattis. The New Comedy was in vigor for about 70 years (320–250 B.C.), having for its foremost representatives Menander Philemon, and Diphilus. The Old Comedy was possible only for a thorough democracy. Its essence was a satirical censorship, unsparing in personalities, of public and of private life—of morality, of statesmanship, of education, of literature, of social usage—in a word, of everything which had an interest for the city or which could amuse the citizens. Preserving all the freedom of banter and of riotous fun to which its origin gave it an historical right, it aimed at associating with this a strong practical purpose—the expression of a democratic public opinion in such a form that no misconduct or folly could altogether disregard it. That licentiousness, that grossness of allusion which too often disfigures it, was, it should be remembered, exacted by the sentiment of the Dionysiac festivals, as much as a decorous cheerfulness is expected at the holiday times of other worships. This was the popular element. Without this the entertainment would have been found flat and unseasonable. But for a comic poet of the higher calibre the consciousness of a recognized power which he could exert, and the desire to use this power for the good of the city, must always have been the uppermost feelings. At Athens the poet of the Old Comedy had an influence analogous, perhaps, rather to that of the journalist than to that of the modern dramatist. But the established type of Dionysiac Comedy gave him an instrument such as no public satirist has ever wielded. When Molière wished to brand hypocrisy he could only make his Tartuffe the central figure of a regular drama, developed by a regular process to a just catastrophe. He had no choice between touching too lightly, and using sustained force to make a profound impression. The Athenian dramatist of the Old Comedy worked under no such limitations of form. The wildest flights of extravagance were permitted to him. Nothing bound him to a dangerous emphasis or a wearisome insistence. He could deal the keenest thrust, or make the most earnest appeal, and at the next moment—if his instinct told him that it was time to change the subject—vary the serious strain by burlesque. He had, in short, an incomparable scope for trenchant satire directed by sure tact.

Aristophanes is for us the representative of the Old Comedy. But it is important to notice that his genius,

while it includes, also transcends the genius of the Old Comedy. He can denounce the frauds of a Cleon, he can vindicate the duty of Athens to herself and to her allies, with a stinging scorn and a force of patriotic indignation which make the poet almost forgotten in the citizen. He can banter Euripides with an ingenuity of light mockery which makes it seem for the time as if the leading Aristophanic trait was the art of seeing all things from their prosaic side. Yet it is neither in the denunciation nor in the mockery that he is most individual. His truest and highest faculty is revealed by those wonderful bits of lyric writing in which he soars above everything that can move laughter or tears, and makes the clear air thrill with the notes of a song as free, as musical, and as wild as that of the nightingale invoked by his own chorus in the *Birds*. The speech of Dikaïos Logos in the *Clouds*, the praises of country life in the *Peace*, the serenade in the *Ecclesiazusa*, the songs of the Spartan and Athenian maidens in the *Lysistrata*, above all perhaps the chorus in the *Frogs*, the beautiful chant of the Initiated,—these passages, and such as these, are the true glories of Aristophanes. They are the strains, not of an artist, but of one who warbles for pure gladness of heart in some place made bright by the presence of a god. Nothing else in Greek poetry has quite this wild sweetness of the woods. Of modern poets Shakespeare alone, perhaps, has it in combination with a like richness and fertility of fancy.

Fifty-four comedies were ascribed to Aristophanes. Forty-three of these are allowed as genuine by Bergk. Eleven are only extant. These eleven form a running commentary on the outer and the inner life of Athens during 36 years, and present varied pictures of ridicule, satire and denunciation. They may be ranged under three periods. The first of these periods, extending to 420 B.C., includes those plays in which Aristophanes uses an absolutely unrestrained freedom of political satire. The second period ends with the year 405. Its productions are distinguished from those of the earlier time by a certain degree of reticence and caution. The third period, down to 388 B.C., comprises two plays in which the transition to the character of the Middle Comedy is well marked, not merely by disuse of the parabasis, but by general self-restraint.

A sympathetic reader of Aristophanes can hardly fail to perceive that, while his political and intellectual tendencies are well marked, his opinions, in so far as they color his comedies, are too indefinite to reward, or indeed to tolerate, analysis. Aristophanes was a natural conservative. His ideal was the Athens of the Persian wars. He disapproved the policy which had made Athenian empire irksome to the allies and formidable to Greece; he detested the vulgarity and the violence of mob-rule; he claved to the old worships of the gods; he regarded the new ideas of education as a tissue of imposture and impiety. How far he was from clearness or precision of view in regard to the intellectual revolution which was going forward, appears from the *Clouds*, in which thinkers and literary workers who had absolutely nothing in common are treated with sweeping ridicule as prophets of a common heresy. Aristophanes is one of the men for whom opinion is mainly a matter of feeling, not of reason. His imaginative susceptibility gave him a warm and loyal love for the traditional glories of Athens, however dim the past to which they belonged; a horror of what was ugly or ignoble in the present; a keen perception of what was offensive or absurd in pretension. The broad preferences and dislikes thus generated were enough not only to point the moral of comedy, but to make him, in many cases, a really useful censor for the city. The

services which he could render in this way was, however, only negative.

ARISTOPHANES, of BYZANTIUM, one of the most famous of the Alexandrian critics, flourished about the middle of the 3d century B.C. He studied under Eratosthenes and Zenodotus, and himself founded a school for grammar and criticism, of which the most distinguished pupil was the great Aristarchus of Samothrace. He was afterwards appointed to the superintendence of the Alexandrian library. Aristophanes, like his great pupil, was celebrated as an Homeric critic, but little is known of the results of his labors on that poet. He seems, however, to have been particularly occupied with the consideration of questions of authenticity. He arranged and commented on the works of Hesiod, Alcæus, Pindar, Anacreon, Callimachus, Plato, and Aristotle; he also explained and wrote arguments to the plays of Aristophanes and the tragic poets. He is justly celebrated as the inventor of the Greek system of punctuation, accent, and breathing. To him, also, is due in great measure the foundation of the well-known Alexandrian Canon.

ARISTOTLE. In the history of European thought and knowledge, down to the period of the revival of letters, the name of Aristotle was, without a rival, supreme; and this supremacy arose from no false estimate or unwarranted preference. Aristotle, speaking generally, treated of every subject which came within the range of ancient thought, and if we regard matter, and not form or literary style, he treated of each of these subjects better than any one else. He also initiated many new branches of inquiry, dependent on observation and induction, and thus not only represented in himself the culmination of Greek speculative philosophy, but was also, as far as possible, the forerunner of modern science. Therefore, the sense of mankind recognized him gradually (after many vicissitudes of appreciation) as the strongest of the ancients. It even came to pass that, for a long period, all secular writings but those of Aristotle had dropped out of notice in Europe. His works may almost have the credit of having saved men from relapsing into barbarism. All sought in Aristotle the basis of knowledge. Universities and grammar schools were founded in Aristotle. Dante only justly expresses this predominance, when he speaks of Aristotle as "the master of those that know," and depicts him as centre and head of the philosophic family. Of the influence which he has exercised over the minds of men we have evidence, not only in the vast literatures connected with his system, which exist in all great libraries, but also in the traces which that system has left in all the modern languages of Europe. The number of Aristotelian "fossils" existing in our everyday language is quite remarkable. If it had not been for the system of Aristotle, we should have had to express many of our ordinary thoughts differently.

The thought of Aristotle takes its start out of two separate sets of elements previously existing in Greece: the one purely philosophical, the other scientific. In Plato were summed up and remoulded all the former results of logical, metaphysical, psychological, ethical, and political speculation in Greece. And Aristotle was, in the first place, thoroughly imbued with Plato, and all the purely philosophical side of his writings was conceived in close relation to Plato's works, the results of which he may be said to have codified, reducing into expository form what Plato had left scattered up and down, rather as hints and suggestions, in his brilliant dramatic dialogues. Partly, then, Aristotle adopted the results of Plato, and made them available for the world in general; partly he dissented from some of the Platonic doctrines, and carried on a polemic against them. To

compare the Platonic dialogues with the works of Aristotle, and to trace the agreements and disagreements between them, forms an interesting study in the history of philosophy. But on the whole, the difference between Aristotle and Plato is one of aims rather than of doctrines. Aristotle's aim, almost from first to last, is to be scientific, and to reduce even philosophy to science. He wishes to deal with what can be known for certain, and to express this in exact language. Plato's aim was, in one sense, greater than this; in another sense it was inferior to it. Plato stood apart from dogmatic systematizing; he seems to have regarded truth as too great and many-sided to be capable of being submitted to such a process; he was content to develop various aspects of the truth, on all the highest questions, as they appeared to different minds, or to the same mind at different periods. To do this he chose the vehicle of the dramatic dialogue, in which nothing was positively announced beyond the views arrived at for the moment by the particular speakers. He was a poet at the same time that he was a philosopher, and his works exhibit that true note of poetry which consists in constant attention to form, so that no part is a mere means to a final result; but each part is treated as an end in itself, and contains its own beauty and perfection. His dialogues are thus masterpieces of consummate literary art, though somewhat indefinite in their conclusions, and not without a tinge of imaginative mysticism. To all these Platonic tendencies in the treatment of philosophy Aristotle was totally opposed. He disregarded form in all his extant works; he thought of matter alone, and his main care was to be definite and exhaustive. In adopting results from Plato he first stripped them of the poetry with which they had been surrounded. We shall revert below to some of the points on which he controverts Plato, but the real contrast between them is in their attitude; the one is essentially a dialectician, though of the highest and noblest type, the other more and more tends to be a man of science. Following out his proper bent, Aristotle, in many of his works, strikes on a path in which Plato had not been his precursor. In these works he lays the foundation for the sciences of Natural Philosophy, Mechanics, Physiology, and Natural History. In these branches of thought he stands related, not to Plato, but to the early Greek writers on physical subjects, the inquirers on special questions, the medical writers, and the travellers, whose works he often mentions, though they are all now lost. If we possessed them, we should probably only see how meagre had been these beginnings of science, and what great things Aristotle achieved in the accumulation and systematising of knowledge, and in preparing the way for its future development.

Aristotle's complete neglect of artistic form (in his extant works), and his adherence "to essential naked truth," induced William von Humboldt to say that Aristotle was un-Greek in the character of his mind; that he was deeper and more earnest than the Greeks, but was wanting in Greek fancy and grace, and spiritual freedom of treatment. This may be so; but in point of descent Aristotle was purely Hellenic. His family, however, had been settled for some generations on the Macedonian frontier, and it was there that Aristotle was born, at the town of Stageira, a Greek colony, on the Strymonic gulf. This place was not far from Pella, the residence of the Macedonian king, Amyntas, whose physician Nicomachus, the father of Aristotle, became. Intercourse with the Macedonians may have, to some extent, influenced the manners of this family. But it is to be remembered that they belonged to the race of the Asclepiads, or supposed descendants of Æsculapius, and it is more natural to attribute the scientific tendencies of Aristotle's mind to the inherited character and

traditions of this race than to any influence which he can have received from the Macedonians. Among those traditions it is said to have been one, that "from father to son they learned the art of dissection, as regularly as others learn to read and write." The best biography of Aristotle, hitherto written, is that given by Grote in his posthumous work (1872, vol. i., p. 3). The chief ancient authority on the subject is Diogenes Laertius, a compiler and anecdote monger, perhaps of the 3d or 4th century A.D. His life of Aristotle contains, amid many worthless, gossiping statements, two fragments of antiquity which are of the greatest value. One of these is an extract from the chronology of Apollodorus (140 B.C.), giving the dates of the chief events of Aristotle's career; the other is a catalogue of "the books which he left behind him," to the number of 146. The following are the statements of Apollodorus:—That Aristotle was born 384 B.C. That he joined Plato and passed twenty years with him, thirteen of them consecutively, and that he came to Mitylene 345 B.C. That in the first year after the death of Plato he went to Hermeas, and abode with him three years; that he came to Philip 343 B.C., when Alexander was fifteen years old; that he came to Athens 335 B.C. That he held a school in the Lyceum thirteen years, and then went to Chalcis 322 B.C., where he died of a disease, about sixty-three years old. This skeleton of the life of Aristotle is probably authentic; and if so, we know as much about him as could possibly be expected. It is easy to fill up, to some extent, the details; he must have been in his seventeenth year when he came to Athens to put himself under Plato; twenty years afterwards, when Plato died, he was, on account of his great divergencies of mind from Plato, not appointed head of the school, and he, therefore, retreated to the court of his philosophical friend, Hermeas, ruler of Atarneus, in Asia Minor; he married the niece of Hermeas, who was a eunuch, and had been a slave. On his death Aristotle went to live in retirement in Mitylene, whence, in his forty-second year, he was summoned by Philip of Macedon to undertake the tuition of Alexander the Great, then fifteen years old. Seven years later Philip was assassinated and Alexander became king of Macedonia, and was immediately absorbed in plans for the conquest of the East. Aristotle now came to Athens and spent the last thirteen years of his life there, and it is these years which have the most interest for us, for in them, in all probability, he composed all those of his works which still remain. In rivalry to the Platonic school which had been established in the gardens of the "Academia" on the west side of Athens, he set up his own school in the covered "walks" round the temple of the Lycean Apollo, on the east side of the city, and from this circumstance his philosophy got the appellation of "Peripatetic." His mind and the general features of his system were now matured; he had before him the task, on the one hand, of reducing to writing for the world the results of his reflections in philosophy, on the other hand, of accumulating fresh materials for those sciences of observation of which he was laying the foundation. He set himself simultaneously to writing and to teaching, and there is reason to believe that he employed his school to some extent, in co-operation with himself, to work out details, and to assist in a subordinate way in the construction of the great philosophical and scientific edifice which he had in view. The period of the zenith of Aristotle was coeval with the astonishing career of his pupil, Alexander. There is a tradition that Alexander furnished him with funds for his physical and zoological researches. However this may have been, it appears certain that Aristotle was identified in Athens with the Macedonian cause, and that when, in the summer of

323 B.C., the startling news of the sudden death of Alexander was spread through Greece, Aristotle was involved in the temporary fall of a political party, and those who, from different causes, were his enemies, made an attack upon him which caused him to fly from Athens. Grote has well drawn out the various elements of enmity existing against Aristotle, and to his account we refer. Aristotle retired to Chalcis in Euboea, a place garrisoned by the Macedonians, and there shortly afterwards closed, in an illness, his life of unsurpassed activity and achievement. His will, preserved by Diogenes, would seem to indicate a kind, just, and generous disposition; of the genuineness of this document we cannot be sure, but there is nothing recorded of Aristotle with any certainty which would lead us to think of him personally otherwise than with respect.

After his death his works had a strange and remarkable history. His library, containing all his own autographs, many of them being MSS. of unpublished and unfinished treatises, was bequeathed to Theophrastus, his chief disciple, who, dying thirty-five years later, bequeathed them in turn, together with his own books and writings, to Neleus, a Peripatetic scholar. Neleus took the whole precious collection with him to his home at Scepsis, in Asia Minor, and his heirs concealed it in a vault to prevent its being seized by the king of Pergamus, who was then levying contributions for his royal library. The Aristotelian MSS. were thus lost to the world for 187 years. About the year 100 B.C. they were brought out of their hiding-place and sold to a wealthy book-collector, named Apellicon, who carried them back to Athens. In the year 86 B.C., on the taking of Athens by Sulla, the library of Apellicon was seized and brought to Rome. There some learned Greeks obtained access to it; Tyrannion, the friend of Cicero, arranged the MSS.; and Andronicus of Rhodes undertook the task of furnishing a correct text, and a complete edition of the philosophical works of Aristotle, out of the materials at his disposal. He arranged the different treatises and scattered fragments under their proper heads, and published what was henceforth received as the authorised edition of the works of Aristotle. It seems reasonable to believe with Grote that "our Aristotle," that is, the collection of writings which under this name has come down to modern times, is none other than the edition of Andronicus, and thus dates from about the year 50 B.C. For the first generation after the death of Aristotle, his scholars, Theophrastus, Eudemus, Phantias, Straton, &c., were engaged partly in editing, partly in paraphrasing, sometimes in endeavoring to improve upon his mostly unfinished works. But the Peripatetic school very rapidly declined; all the philosophic ability round the shores of the Ægean threw itself into one or other of the two new rival schools which had arisen, the Stoic and the Epicurean. The Peripatetics could not keep up to their master's level; they soon lost interest in the higher parts of his system; they took to writing monographs on small separate questions, and moral platitudes dressed up in rhetorical form. We may hesitate to affirm that, during 187 years, there were absolutely no copies of Aristotle's greatest works extant besides those hidden in the vault of Scepsis, for the Stoical ethics and logic both bear traces of a knowledge of Aristotle. But, at all events, for the time, the world had lost its interest in all that we most prize in Aristotle's thought. Strabo says expressly that "all his writings, except a few of a more popular character," had been lost; and in accordance with this, Cicero says that "even philosophers know nothing of Aristotle, though they ought to have been attracted by the incredible sweetness of his diction." The latter part of this remark may seem surprising, for

it is not in the least applicable to any of the works of Aristotle which have come down to us. But Cicero is evidently referring to the Dialogues, which were read, admired, and attributed to Aristotle in the days before the edition of Andronicus became known. The question has been raised, especially by Valentine Rose, whether these dialogues, and other short, unsystematic works which passed under the name of Aristotle, were all forgeries, or were in any case genuine. On the one hand it is urged that the dialogic, or artistic, mode of exposition, was alien from Aristotle's turn of mind. On the other hand, it may be said that Aristotle in his youth may very probably have tried his hand at imitating the Platonic dialogues. And, indeed, unless he had done so, it is difficult to understand how even the forgers could have ventured to publish dialogues bearing his name. Very likely, after his death and the loss of the main bulk of his works by their removal to a vault in Asia Minor, a crop of forged Aristotelian writings sprang up, and imitations of his earlier and more popular works were among the number. But still, it appears safest to believe that Aristotle did at one time endeavor to make the dialogue his vehicle for philosophy. In the years that followed the death of Plato, he probably felt within himself a reaction and repugnance against this mode of writing, and when he returned to Athens as the leader of a school, he utterly renounced it, and set himself henceforth to the statement of the naked truth in the directest and most scientific terms which he could find. Whether the dialogues which Cicero and his contemporaries read and admired were early works of Aristotle himself, or were forgeries, there is no means of knowing. But the fragments of these works, which a search of all ancient literature has brought together, show us nothing worthy of Aristotle in his best days, nothing that contributes any light to his philosophy. And it is remarkable that all works of this kind seem to have been excluded from the edition of Andronicus. Owing to that exclusion they are all now lost, and thus the tables are turned, for whereas before the edition of Andronicus the world had forgotten all about Aristotle, except so far as he was represented by his own youthful and lighter productions, or by spurious imitations of these, it came to pass later that all except his solid and great philosophical treatises passed into oblivion.

Of the works that have come down to us as Aristotle's, the following are undoubtedly genuine:—1. *Topics*. 2. *Prior Analytics*. 3. *Posterior Analytics*. 4. *On Sophistical Refutations*. 5. *Art of Rhetoric*. 6. *Nicomachean Ethics*. 7. *Politics*. 8. *On the Art of Poetry*. 9. *A Physical Discourse*. 10. *On the Heavens*. 11. *On Generation and Destruction*. 12. *Meteorologies*. 13. *Researches about Animals*. 14. *On Soul*. 15. Appendices to the preceding work—(a.) *On Sense and Sensible Things*. (b.) *On Memory and Recollection*. (c.) *On Sleep and Waking*. (d.) *On Dreams and Prophesying in Sleep*. (e.) *On Longevity and Short-livedness*. (f.) *On Youth and Old Age*. (g.) *On Life and Death*. (h.) *On Respiration*. 16. *On Parts of Animals*. 17. *On Locomotion of Animals*. 18. *On Generation of Animals*. 19. *The Metaphysics*.

The following works attributed to Aristotle are almost undoubtedly spurious:—1. *On Rhetoric; addressed to Alexander*. 2. *Eudemian Ethics*. 3. *Great Ethics*. 4. *On Virtues and Vices*. 5. *Economics*. 6. *On Colors*. 7. *Physiognomics*. 8. *On Plants*. 9. *On Strange Statements*. 10. *Mechanics*. 11. *On Indivisible Lines*. 12. *On Xenophanes, Zeno, and Gorgias*. 13. *On the Universe; addressed to Alexander*. 14. *On Motion of Animals*. 15. *On Breath*. 16. *Problems*.

We shall now proceed briefly to indicate, we cannot attempt more, the leading features of the contents of Aristotle's undoubted work, as they have come down to us. The books of the *Organon* (so called by Andr.) form together a connected whole. Of these the *Topics* appear to have been written first, but the sequence of thought between the books is that the *Prior Analytics* stand first, as containing the theory of the syllogism, a necessary preliminary to reasoning of all kinds; and then growing out of this root we have two divergent treatises: the *Posterior Analytics*, on demonstrative reasoning, or the logic of science; and the *Topics*, on dialectic, or the art of discussing subjects in which demonstration is impossible. For the details contained in these treatises we must refer the reader to Grote's generally excellent account. The matter of the *Prior Analytics* has become the common property of all modern books on logic. And scarcely anything has had to be detracted from or added to what Aristotle wrote upon the syllogism. His was the proud distinction of having discovered and fully drawn out the laws under which the mind acts in deductive reasoning. That in deduction the mind proceeds from some universal proposition, and how it proceeds—these were the first things which Aristotle had to tell the world. The modern attempts to impugn these principles, and to show that the mind does not reason from universals, are a failure. They confuse inductive with deductive reasoning, and ignore both the case of a science like geometry, which is all deduction, and also the numerous cases where the mind, having unduly assumed a universal principle, rests in it afterwards and makes deductive applications of it. Granting that there is such a thing as deductive reasoning (and surely life is full of it), it is a great matter to have the laws of this so clearly ascertained, that about the process itself there can no longer be doubt, and any flaw in the process can instantly be detected. This was the service that Aristotle rendered in drawing out the laws of the syllogism. Men, of course, reasoned deductively by means of "the syllogism" before Aristotle had appropriated this name to indicate the formula for deductive reasoning, and before he had discovered and stated the laws under which the mind acts in deductive reasoning. They did so, however, unconsciously and by instinct, just as men wrote and talked grammatically before any idea of a science or an art of grammar existed. In Aristotle deductive reasoning became conscious of itself. Unfortunately for his reputation, this merely preliminary part of his labors, in which the principles and rules of syllogistic inference were drawn out, occupied almost exclusively the minds of thinkers in the Middle Ages. The errors of modern Aristotelians were imputed to Aristotle, and hence arose the notion that Aristotle explained nature by means of the syllogism. Nothing could be further from the truth; Aristotle was not only one of the most inquiring and encyclopædical, but also one of the most thoroughly sensible, of all writers, and no one would have repudiated more strongly than himself the idea that the formula of the syllogism can be used to test or explain anything beyond the process of reasoning from certain premises possessed or assumed, and he is never tired of telling us that the only means of obtaining premises is by experience and observation of facts. While discussing the syllogism itself, he says,—"This is the case in astronomy, which is based on the observation of astronomical phenomena, and it is the case with every branch of science or art. When the facts in each branch are brought together, it will be the province of the logician to set out the demonstrations in a manner clear and fit for use." It is true that Aristotle did nothing towards

the logic of Induction, that is to say, towards elucidating the methods by which the mind legitimately arrives at general facts or laws of nature. This was left to be worked out by the moderns, by Galileo, and Bacon, and Whewell, and J. S. Mill. Aristotle, indeed, made a cursory attempt to put the inductive process into syllogistic form, thus: "A, B, and C draw iron; A, B, and C are (or represent) all magnets; therefore all magnets draw iron." It is clear that this syllogism does not explain the inductive process, it only records in the minor premiss a previous induction. The real question is, do A, B, and C here properly represent all magnets? To answer this, verification would be required. The syllogism, then, does not explain the inductive process, but only calls attention to what is implied in it. Leaving unattempted the question how the minor premiss in the Inductive syllogism is to be obtained, and how tested, — what Aristotle really works out is the logic of Deductive Science (in the *Post. Analytics*) and the logic of Deductive Probability (in the *Topics*). Under the former head he draws the ideal of a perfect science, and recounts the conditions necessary to its existence. Interesting discussions are introduced by him on Causation, Hypotheses, Axioms, Ultimate Laws, Definition, and the Apprehension of Primary Truths. In all this there is little which might not be accepted by a man of science of the present day. The *Topics*, on the other hand, treat of a subject which possesses rather an antiquarian than a living interest, namely, the conduct and regulations of Dialectic as practised in Athenian society.

Hardly anything of importance on the subject of Rhetoric has been added to what Aristotle wrote. Take the most powerful and subtle specimen of modern oratory — for instance, Shakspeare's speech of Mark Antony over the body of Cæsar — and you will find the *rationale* of every telling point set forth by anticipation in the *Rhetoric* of Aristotle. His work contains some few Greek technicalities — for instance, the doctrine of the Enthymeme, or rhetorical syllogism — on the precise nature of which commentators are not agreed. But the main bulk of the treatise consists of a rich collection of remarks on human nature and life, applicable to all periods. In the wisdom and knowledge of the world which it exhibits, Aristotle's *Rhetoric* might be compared with the *Essays* of Lord Bacon. And it might be compared with them also in this respect, that a bad and Machiavelian use might certainly be made of some of the suggestions which it contains, though Aristotle professes only to give them to be employed in the interest of truth and justice. The third book, on Style, is excellent so far as it goes, but it is less exhaustive and universally applicable than the former books, which treat of the matter of speeches.

Rhetoric was said by Aristotle to be allied, on the one hand, to Dialectic, on the other hand to Ethics; and, accordingly, he seems to have gone next to the exploration of the latter subject. At all events he wrote the *Nicomachean Ethics* later than the *Rhetoric*. When we compare the two treatises together we are struck with the growth of mind which has taken place between them. The *Rhetoric* is full of ethical definitions of happiness, pleasure, virtue, friendship, and the like. But in the *Ethics* these are all remodelled, and made far deeper and more exact.

The *Nicomachean Ethics* was, perhaps, the first of Aristotle's extant works which entered upon the matter of knowledge, as distinct from the theory of the reasonings by which knowledge is obtained, and from the theory of the statement by which knowledge may be best set forth. The moral system herein contained differs from the ethics of Plato, *first*, in its more accurate psychological analysis, in distinguishing the will

from the intellect, and in making virtue to consist in a formed state of the will, rather than in wise insight; *secondly*, in being disconnected from any assumption, or theory, of the immortality of the soul, — from all that we should call "Faith." Whether or not Aristotle denied a future life is another question to be considered later. But at all events he constructed ethics independently of such a doctrine. On the other hand, his system differs from the modern point of view, in that he asks, not, What is right? what is our duty? or what is the ground of moral obligation? but, What is the chief good for man? In order to answer this question, he calls in the aid of his metaphysical forms of thought, such as the doctrine of the Four Causes, and of Actuality and Potentiality. From these he deduces that the chief good for man must consist in something which is an End in itself, and that it must be found in the actuality of the human powers. It is a weak point in the system that, instead of at once recognising the law of moral obligation as the deepest thing in man, it introduces the idea of virtue and morality in a dry logical way, saying that the chief good for man must be the actuality of his powers according to their own proper law of excellence.

But the whole question of man's moral nature is really subsidiary in the *Ethics* of Aristotle. His question is, What is the chief good for man? and the answer to this question is, It must consist in the evocation and actuality of man's highest faculty, namely, the Reason. Thus, the highest happiness is to be found in contemplation and speculative thought; the joys of the philosopher are beyond compare. A satisfaction of an inferior kind is to be found in the exercise of the moral virtues. Such is, in brief, the view which Aristotle gives of human life. He excludes religion from his consideration of the subject, though his disciple, Eudemus, in restating his conclusions, tries to introduce it. The same question, What is the highest good for man? has been answered in somewhat similar terms, in modern times, by Spinoza.

The concluding paragraphs of the *Nicomachean Ethics* form the prelude and introduction to the *Politics* of Aristotle. Neither virtue nor happiness, he says, can be attained by the individual separately. Moral development and the realization of our powers require as external conditions a settled community, social habits, the restraint and protection of laws, and a wisely-regulated system of public education. Man is by nature a political creature; he cannot isolate himself without becoming either less or more than man. Thus the state is a prime necessity to man, and, indeed, the state is prior in idea to the individual, that is to say, the normal conception of man is of man in a state of civilisation, and this implies beforehand the conception of a state. On these grounds Aristotle went on from his *Ethics* to the composition of his *Politics*. Some little time, however, may have elapsed between the two works. This is suggested by the mature and free handling given to ethical questions when they occur in the *Politics*. Aristotle, with his usual tendency to seek a solid basis of experiences for his theories, may, in this interval, have been engaged in making that remarkable collection called the *Constitutions* which, according to Diogenes Laertius, contained a description and history of the constitutions, manners, and usages of 158 states, and of which numerous fragments remain. However this may be, the *Politics*, as we possess them, are full of learning and information.

His ideal state contrasts favorably, from a scientific point of view, with that of Plato. For while giving, as we have seen above, great and predominant weight to the idea of the state, he refuses to allow the individual and the family to be absorbed by the state. He thus

resists all approaches to that communism which was carried to so great extravagance in the *Republic* of Plato. The form of government which, ideally speaking, he prefers, is a wise monarchy or aristocracy—some government, in short, in which neither wealth nor numbers shall be permitted to determine everything. In some points it must be confessed that he exhibits a narrow and conservative spirit, and a belief in the divine right of things as they are, which puts him at a disadvantage in comparison either with Plato or with modern views. Thus, despite counter opinions in his own day, he maintains the institution of slavery as based on nature, and even lays it down that it is justifiable to make war upon and reduce to slavery those races who were evidently intended by nature to be subject. In accordance with his physiological system, he treats woman as stunted man, fixed by nature in a position of inferiority; and, therefore, he resists Plato's proposals for the emancipation and improved education of women. And by a third misapplication of his favorite conception of "nature," he denounces interest as unnatural, money being a mere instrument of exchange, whereas interest unnaturally increases it.

The logical order of the physical treatises, and, probably to a great extent, the actual order of their composition, is as follows:—1st, The *Physical Discourse*, in eight books, forms an introduction to the entire subject. It is, as Hegel called it, "a Metaphysic of Physic." It treats of the Principles of Existence, Matter and Form, Nature, Motion, Time, Space, the Unmoved First Mover, and the Evermoved, *i.e.*, the sphere of the outer heaven. 2d, The treatise *On the Heavens*, in four books, naturally succeeds; and Aristotle, thus beginning with the periphery and divinest part of the universe, descends gradually to the region of the material and perishable. In so doing it becomes necessary to him to consider the causes of those changes,—that passing into and out of existence,—which had no place in the higher region. Therefore, 3d, the treatise *On Generation and Destruction*, in two books, gives us Aristotle's theory of the Hot and the Cold, and the Wet and the Dry,—pairs of opposites, the first pair active, and the second pair passive, which by their combinations and mutual workings produce the four elements (Hot and Dry=Fire, Hot and Wet=Air, Cold and Dry=Earth, Cold and Wet=Water), and form the ground for all natural changes. 4th, The *Meteorology*, in three books, treat of the region of the planets, comets, and meteors,—a region ever full of change and alteration. The fourth book of this treatise does not logically belong to it, for in it Aristotle develops his theory of two exhalations—the steamy or wet, and the smoky or dry—which, being imprisoned within the earth, produce, the former the metals, and the latter the rocks, and such other minerals as are incapable of being melted. This theory, which seems to be a dim foreshadowing of the doctrine of crystallisation, takes us out of the mid-air below the surface of the earth. It is, therefore, out of place; but almost everything in Aristotle must be looked upon as unfinished. 5th, The treatise *On the Parts of Animals*, in four books, leads the way to the investigation of organic life. It contains Aristotle's physiological distinction between homogeneous and unhomogeneous substances (*ὁμοιομερῆ* and *ἀνομοιομερῆ*), *i.e.*, tissues and organs. This distinction, which is recognised still as perfectly valid, gives a scale of ascension from the inorganic to the organic world. First, Heat and Cold, &c., form the simple elements; out of the elements are formed the homogeneous substances or tissues; out of these are formed the organs, out of the organs the organised being. As a principle of method, Aristotle

lays it down that all which is common to the various species of living beings should be discussed before entering upon their specific differences. Therefore, 6th, the treatise *On Soul* follows next in order, which, as Spengel observes, is not to be regarded as a work of psychology in the modern sense, but as a physiological treatise on the soul of vital principle common to all living beings. And next follow, 7th, the so-called *Parva Naturalia*, which form appendices to the three books *On Soul*, and treat physiologically of sense and sensation, youth and age, sleep and waking, and other phenomena attaching to life in general. 8th, The short essay *On Locomotion of Animals* shows how various organs in the various creatures are adapted by nature for this purpose. 9th, The elaborate treatise, in five books, *On Generation of Animals*, works out this subject with astonishing fullness. And, 10th, the great work entitled *Researches about Animals*, in ten books, in which Aristotle exhibits an acquaintance, more or less intimate, with about 500 species, crowns the series of his physical writings, and certainly constitutes one of his greatest achievements.

Last of Aristotle's extant and undoubted works, we have to deal with the *Metaphysics*.

Among the many-sided merits of Aristotle must be mentioned the example set by him of making the history of opinion on each subject the prelude to a scientific consideration of the subject itself. In the first book of his *Metaphysics* he sketches the leading doctrines of his predecessors on the first principles of existence. He thus becomes the father of the history of philosophy, a study which has been taken up anew and much developed during the present century. His brief and masterly sketch is, however, open to the charge of not doing sufficient justice to the different points of view of former philosophers. And his polemic against Plato's doctrine of Ideas, which is several times repeated in his extant writings, has the appearance of captiousness, and of misrepresenting the doctrine which it impugns. Aristotle himself never discarded idealism. He declared that universals, and the truths apprehensible by the highest reason, "were by nature more known" than individual concrete phenomena, and the facts apprehended by sense. But yet he had the strongest bias towards physical research and empirical observation. A modern physical philosopher might have been content to follow out his own special inquiries without seeking a general scheme for the universe. But Aristotle had to form a theory of the whole, leaving scope, afterwards, for the separate physical sciences. The idealism of Plato did not do this; it left no place for matter, motion, or change; when followed out it reduced all but the Ideas to the category of the non-existent. Aristotle, to rescue all nature from theoretical annihilation, introduced a term between the existent and the non-existent, namely, the "potential." On the one hand, the potential does not exist, for as yet it has no qualities; on the other hand, it does exist, for some change brings the "actual" into existence, and this could not be without implying the previous existence of the potential. The universe, according to Aristotle, is a continuous chain; at the one end is the purely potential—matter without form or qualities; at the other end is pure unconditioned actuality, the ever existent, or God.

Reflection upon the relation of the potential and the actual shows the world to have been eternal, for the actual must always have preceded the potential; the seed is the potentiality of the plant, and the plant must have always preceded the seed, the fowl the egg, &c. Thus, all the system of cause and effect, which makes up what is called "nature," has been and will be, according to Aristotle, of eternal duration, and is only slightly

modified and altered by two incalculable elements of causation,—chance and the will of man.

The history of the study of the Aristotelian philosophy, since the time of Andronicus, falls under various heads, dealt with elsewhere. It is contained, —*first*, under such names as those of the Greek commentators, Boethius, Nicolas Damascenus, Alexander of *Ægæ*, Aspasius, Adrastus, Galenus, Alexander of Aphrodisias, Porphyry, Iamblichus, Dexippus, Themistius, Proclus, Ammonius, Damascius, David the Armenian, Asclepius, Olympiodorus, Simplicius, and Johannes Philoponus; *secondly*, under the history of the caliphs of Baghdad, and their encouragement of the translation into Arabic of Greek philosophical works; *thirdly*, under the names of Avicenna (of Baghdad), and Averroes, and Moses Maimonides (of Cordova), and the history of the controversies to which they gave rise; *fourthly*, under the names of Thomas Aquinas, and the history of Scholasticism generally; *fifthly*, under the history of the Renaissance, and of the manifold editions of Aristotle to which the first age of printing gave birth; *sixthly*, under the names of Ramus and Bacon, and the history of the reaction against scholastic Aristotelianism; *seventhly*, under the names of Lessing, Hegel, and other great Germans who, within the last hundred years, have revived a genuinely philosophical and critical study of Aristotle.

ARISTOXENUS, of Tarentum, a celebrated Greek philosopher and writer on music, was the son of Spintharus or Mnesias. He was at first a pupil of the Pythagorean school, and received instruction from Xenophilus; afterward removing to Athens, he studied under Aristotle. He became one of the most distinguished pupils of the Peripatetic school, and is said to have been much disappointed when, after the death of Aristotle, Theophrastus was preferred to him as a scholar. His writings, which, according to Suidas, were 453 in number, have been almost entirely lost.

ARITHMETIC is the science that treats of numbers, and of the methods of computing by means of them. In introducing the subject, and endeavoring to trace the progress of the science, there appear to be three points that call for particular notice, viz., the conception of number, the representation of numbers either by words or graphically by characters, and the principles and modes of computation.

1. The primary conceptions of numbers are necessarily of a very crude kind. The child attains the notion slowly by experience, and the ability that even adults have to apprehend the significance of numbers with precision is restricted to an extremely narrow area. This is still more the case among uncivilized races, some of which do not appear to be able to count beyond 3, or 4, or 5, or are at least believed to have no words in their vocabularies that express larger numbers. It is to be remembered that the knowledge that is acquired regarding numbers through experience and culture is not of numbers absolutely or in the abstract, but rests almost entirely on a preception of the relations which numbers bear to each other.

The power to form a direct and immediate conception of numbers is very limited; but the relative magnitudes of numbers, large as well as small, can be expressed with the utmost accuracy, and so as to be clearly understood. The system of notation in common use, whereby we express not merely numbers, but parts of numbers, supplies us with means of comparing arithmetically together either the greatest or the minutest magnitudes, to which there is absolutely no limit. The proportion, for instance, that the circumference of a circle bears to the diameter, though it cannot be stated with arithmetical exactness, has been calculated to upwards of 200 deci-

mal places—a nicety for which the vast dimensions that science discloses in the physical universe furnish no means of comparison whatever. For let it be supposed that a circle were described, with a point on the earth's surface as center, so as to extend beyond the most distant star that can be discerned by the most powerful existing telescope, that the radius of the circle were known, and that the circumference were computed from it, it does not appear that an error in the thirtieth decimal place would be of such magnitude that the keenest vision, aided by the most powerful microscope, could detect it.

In all systems of number, with the exception, perhaps, of the very rudest, numerical conceptions are aided by the introduction, usually at a very early stage, of methods of grouping. In nearly every case the methods adopted connect themselves with the number of the fingers, either of one or, more usually, of the two hands. Having reached 5 or 10, the reckoner proceeds by adding to these the prior numbers; and when a second 5 or 10 is reached, a new word or sign is employed, the significance or derivation of which is generally well marked in the name or form it bears. Similarly when (say) five fives or ten tens are reached, a fresh start is made. These processes of grouping are of great importance, conveying clearer conceptions than could otherwise be obtained of the relative magnitudes of numbers. An additional evidence of the value of the principle is to be found in certain numerical combinations which are not additive, as such combinations mostly are, but subtractive. Thus, if a conception be formed of 10, and again of 20, 19 and even 18 will connect themselves more readily with the latter than with the former, and so we have such forms as *duodeviginti* and *undeviginti*; and there is little doubt that similar considerations, in combination with a regard for brevity of expression have led to the use of the subtractive forms IX., XL., &c.

2. There are two ways in which numbers are represented,—either in words or by particular characters or symbols. It is with the latter that arithmetic has more especially to do, the numerous important and interesting questions that relate to word-numerals falling rather within the domain of language. It is only in so far as they arise out of the systems of grouping already referred to, suggesting in their formation such processes as addition or multiplication, that these call for any notice here. Dr. Tylor (*Primitive Culture*, chap. vii.) gives a variety of remarkable collocations of this sort, as well as of descriptive numerals, that are in use among different races and tribes.

There is also a common use of characters to represent numbers which does not properly belong to this subject. The letters A, B, C, &c., or α , β , γ , or the like, the order to whose succession is fixed, are often employed to indicate numerical order, either singly or in combination with numerals proper. This is not, however, an arithmetical use of the characters; they are merely *ordinals*, and cannot furnish a basis for calculation.

The origin of the various characters which have been employed to indicate numbers proper, and by means of which computations can be effected, is in most cases alphabetical. In the Hebrew and Greek notations, for instance, the letters were taken in the main in their alphabetical order, being divided into three groups, of which the first represented units, the second tens, and the third hundreds; and very similar systems have been in use among other nations.

Far superior to all the ancient systems, and indeed to every other system that exists, is the arithmetical notation that is in common use. The Arabic numerals, as they are called, are ten in number, nine of them repre-

sents the first nine numbers, and the tenth, the cipher or zero, indicating the absence or negation of numerical value. The significance of these figures or digits depends on their relative position, and the great merit of the system is due to this element of local value. Standing singly, the figures denote simply one, two, three, &c.; but in combinations of them every removal towards the left increases the value of the figures ten times. In 5673, for instance, the 3 denotes three, the 7 seven tens (70), the 6 six times ten tens (600), the 5 five times ten hundreds (5000). Should any of the series of tens be wanting, as in nine thousand and forty-eight, where hundreds do not occur, the place is supplied by a cipher, which throws back the digit that expresses thousands into its proper place, thus 9048. It is by this use of the cipher in supplying blanks, and so regulating the places of the significant digits that the principal of local value is carried out. See further the sections on notation and numeration.

The ordinary numerals are called Arabic, and it appears to have been through the Arabians that they were introduced into Europe; but they are now generally acknowledged to be of Indian origin. As may be imagined, they have passed through a great variety of forms, one of the earliest types of them being the *Devanagari*, a species of Sanskrit numerals. In the early Indian treatise of Bhascara and Brahmagupta, translated by Mr. Colebrooke (see article ALGEBRA), as well as in the still earlier writings of Arya-Bhatta, there are both indications and illustrations of the use of the nine digits and the cipher; and the system is thus traced back to the 7th, and in all probability to the 5th century of the Christian era. Even then it was evidently no novelty, but is alluded to as holding an established position; and the Hindu writers nowhere lay claim to the invention of it, but constantly assign to it a supernatural origin. The method was known to the Arabians in the 9th century; and in the course of the 10th it seems to have come into general use among them, especially in their astronomical writings and tables. It was probably in the following century that the Arabs introduced the notation into Spain; but in regard to this we have no explicit information, and different accounts are given of the earliest instances of the use of the system in Europe. On the one hand, it is alleged that the figures first occur in a translation of Ptolemy, of the date 1136, while others maintain that they were introduced (about 1252) by means of the celebrated astronomical tables published by and named from Alphonso the Wise. That their use was known in Italy at the commencement of the 13th century, appears to be satisfactorily established, for there is no good reason to doubt the genuineness of the MS. writings of Leonardo of Pisa, copies of which have been found bearing the dates 1202 and 1220. Numerous other instances are given of the early use of the nine figures and the cipher, especially by astronomers, and in calendars. The great superiority of this to earlier modes of numerical expression became gradually apparent, and in course of time it came into almost universal use among civilised nations.

For a time there was, not unnaturally, considerable inexactness or confusion in the employment of the notation. In early writings such combinations are found, for example, as X2 for 12, 301 for 31, &c. In the latter case the law of local value is lost sight of, and the characters 30 are used as equivalent to thirty, irrespective of their position.

3. Calculation or computation by means of numerical characters is what is ordinarily regarded as the distinctive province of arithmetic, and the worth of a sys-

tem of notation is to be estimated by the facilities it affords for the operations of reckoning.

Computation of a comparatively rude kind was often carried on in ancient times, and is practised still in some countries, by what are called palpable methods,—as, for instance, by means of counters, or by balls strung on rods or running in grooves.

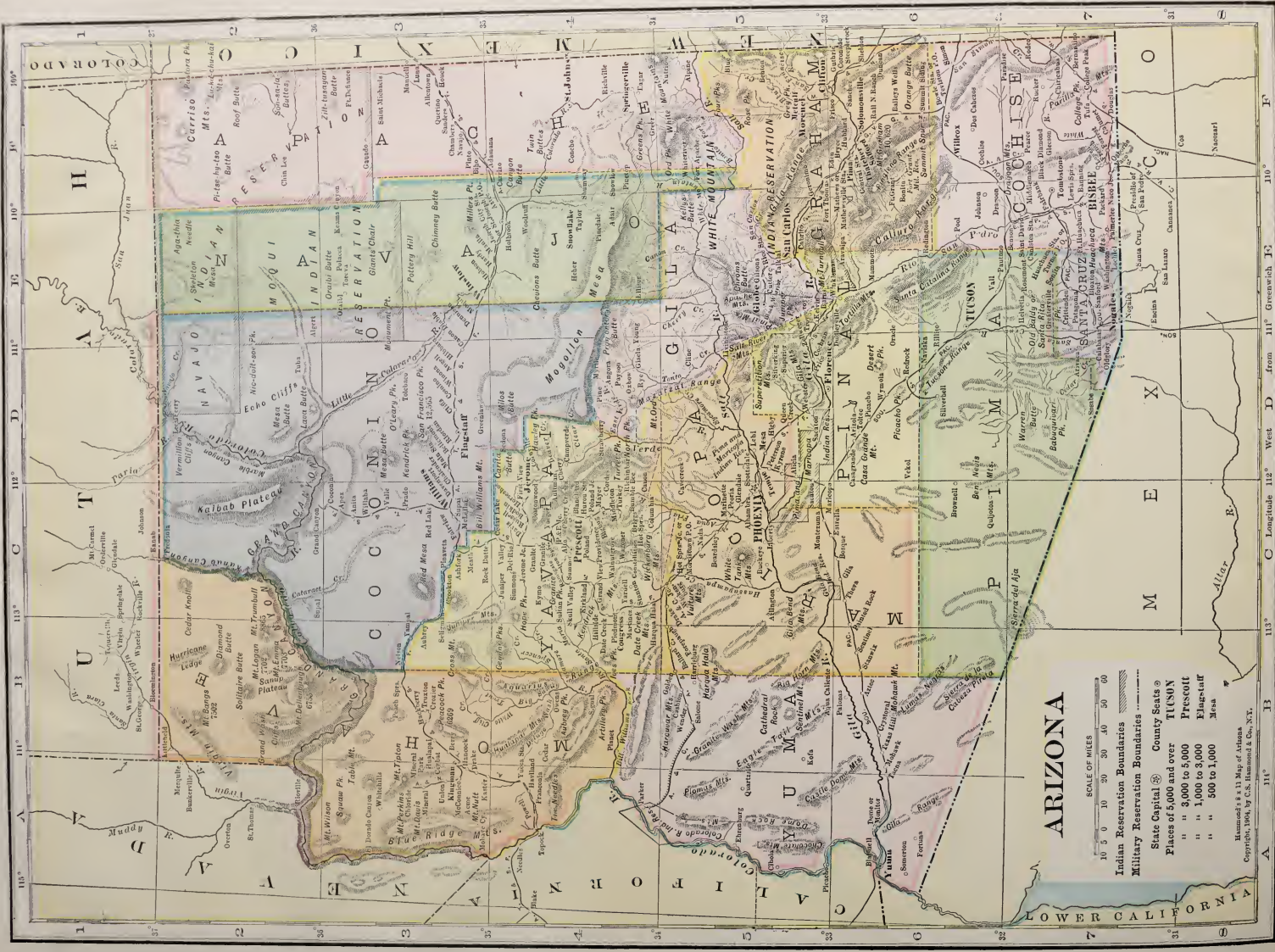
The methods that preceded the adoption of the Arabic numerals were all comparatively unwieldy, and very simple processes involved great labor. The notation of the Romans, in particular, could adapt itself so ill to arithmetical operations, that nearly all their calculations had to be made by the abacus. One of the best and most manageable of the ancient systems is the Greek, though that too is very clumsy.

The operations of the Greek arithmetic involving fractions were necessarily very complicated. A simpler system was introduced (by Ptolemy, according to his commentator Theon, but it appears to have existed before his time) in what are known as *sexagesimals*, which are precisely analogous to the duodecimals by which we sometimes calculate areas. The division of the circle into 360 degrees arose, no doubt, from 360 approximating the number of days in the year, and containing a large number of divisors. The radius of the circle, or side of the inscribed hexagon, subtended at the centre 60 of these degrees, and from this the degree was again divided into 60 parts called minutes, the minute into 60 seconds, &c., just as the foot is divided into 12 inches, the inch into 12 seconds, &c., in duodecimals. The sexagesimal system, though applied in the first instance to circular, was also employed in linear, measurements.

The most important step in the progress of modern arithmetic was the introduction of decimal fractions, and the extension of the Arabic notation to the expression of them. The first writer who advocated and exemplified the use of decimals was Simon Stevin de Bruges, better known as Stevinus, in a paper published about 1585; but he employed an awkward notation, and it was only after a considerable period that they assumed the form—entirely consistent with the notation of integers—with which we are familiar. From a form which Lord Napier employs in his *Rabdologia* (1617), the introduction of the decimal point (as a comma) has been ascribed to him, but apparently without sufficient evidence.

ARIUS, a well-known name in ecclesiastical history, identified with the origin and spread of the first great “heresy” in the Christian church. Arius is supposed to have been a native of Cyrenaica in Africa, but nothing is really known of his birth or of his early training. He first comes clearly into view as a presbyter of the Church of Alexandria, in the commencement of the 4th century, engaged in conflict with his bishop, Alexander. At a previous period he is said to have been connected with the Meletian schism, and on this account to have been excommunicated by Peter of Alexandria, who had ordained him deacon.

The views of Arius first attracted attention about 319 A.D. According to the church historian Socrates, Bishop Alexander, in addressing the presbyters and other clergy on the doctrine of the Trinity, dwelt so strongly on the consubstantial unity of the Father and the Son that Arius charged him with holding Sabellianism. A different account is given by profane historians—notably Sozomen. Arius’ belief is set forth in the following: “We believe,” he says in the letter to Alexander, “in one God alone without birth, alone everlasting, alone unoriginate. . . . We believe that this God gave birth to the only begotten Son before eternal periods, through whom He made these



ARIZONA

- SCALE OF MILES
10 5 0 10 20 30 40 50 60
- Indian Reservation Boundaries
 - Military Reservation Boundaries
 - State Capital
 - County Seats
 - Places of 5,000 and over
 - Places of 3,000 to 5,000
 - Places of 1,000 to 3,000
 - Places of 500 to 1,000
 - Area

Hammett's 1906 Map of Arizona
Copyright, 1906, by C.S. Hammett & Co., N.Y.

periods and all things else; that He gave birth to Him, not in semblance, but in truth giving Him a real existence, at His own will so as to be unchangeable, God's perfect creature, but not as other creatures . . . not, as Valentinus maintained, a development; nor, again, as Manichæus a consubstantial part; nor as Sabellius, Son and Father at once, which is to make two out of one, . . . but created by the will of God, and endowed with His own glorious perfections—yet not so that the Father did thereby deprive himself of attributes which are his without origination, being the Source of all things; so that while there are three persons yet God is alone the Cause of all things and unoriginate. The Son, on the other hand, is originate, begotten by the Father time-apart. The Son is not, therefore, co-eternal or co-unbegotten with the Father, as if these were two unbegotten principles; but God is before all things as single and the principle of all, and therefore, before Christ also."

Such were the questions which distracted the church beyond all precedent in the beginning of the 4th century, and led to the first great oecumenical council, which was convened in Nicæ in 325. The account of the proceedings of this council will be given under its own heading. It requires only to be mentioned here, that after various turns in the controversy, it was finally decided against Arius, that the Son was "of the same substance" (*ὁμοούσιον*) with the Father, "very God of very God."

Although defeated at the council of Nicæ, Arius was by no means subdued. He obtained means of access to Constantia, the sister of the emperor, who, on her death-bed, strongly urged her brother to reconsider the question, and to recall the heresiarch from banishment. Restored to court, he, along with the Eusebian party, who, although professing to accept the Nicene doctrine, were in reality indifferent, if not hostile, to it, renewed the theological strife, in which Athanasius was nothing loath to join. Interchanges, now of friendly recognition and now of menace passed betwixt the emperor and the intrepid bishop of Alexandria, who obstinately refused to reinstate Arius as presbyter. At length, on the banishment of Athanasius to Treves in 336, Arius returned to Alexandria to claim his old position; but even in the absence of the bishop the people rose in up-roar against the heretic, and the emperor was forced to recall him to Constantinople. There the bishop was reluctantly compelled to profess his willingness to receive him once more into the bosom of the church, but before the act of admission was completed Arius was taken suddenly ill, while walking with a friend in the evening, and died in a few moments.

ARIZONA, a territory of the United States, bounded N. by Utah, E. by New Mexico, S. by Mexico, and W. by California and Nevada, with an estimated area of 112,920 square miles. According to the Act creating it a territory in 1863, Arizona comprises all the lands of the United States formerly belonging to New Mexico, extending from W. long. 109° to the California line. Since then, however, the N. W. corner has been ceded to Nevada. The territory lies in the basin of the Colorado river, which enters it in about 37° N. lat., and forms its western boundary southward from 36°. In the north there is an extensive but barren plateau, with an average elevation of 7,000 feet, through which the Colorado cuts its way, and forms one of the most remarkable gorges in the world, the length being about 300 miles, and the perpendicular walls reaching heights of from 3,000 to 6,000 feet. South of this plateau is the valley of the Colorado Chiquito (Little Colorado, or Flax river), which joins the Colorado in 36° 15' lat. N. and 113° long. W., while further south the ground

rises into another plateau, the main portion of which is known as the Mogollon Mountains. In this district the country is reported to be beautiful and fertile, the mountains covered with noble pine trees, and the valleys clothed with rich grama grass. Farther south, again, is the basin of the Gila, with its numerous tributaries, obliquely crossed by detached prolongations of the Sierra Madre of Mexico. Of the inhabitants of Arizona 25,000 are Indians. Of these 4,300 Pinas and Maricopas occupy a reservation of 64,000 acres on the Gila river; 4,000 Papagoes, a wandering tribe in the south-eastern part of the territory, have no grounds allotted them; 4,000 Mojaves have 75,000 acres on the Colorado river; 2,000 Yumas live near the mouth of Colorado, but belong to the Mojave reservation; while 1,500 Hualapais and 8,000 or 9,000 Yavapais and Apaches, without settled habitations until recently lived in a state of warfare with their neighbors. Civilization, however, is gradually asserting her claim to those fertile districts. Arizona is rich in mineral products—nearly all the mountains in the south and center yielding gold, silver, copper and lead. Lime, gypsum, and coal are also present, and salt of excellent quality exists in extensive deposits. The vegetable productions are iron-wood, mesquite, cotton-wood, sycamore, ash, oak, willow, walnut, prickly pear, cactus, aloë, artemisia; and, under cultivation, grapes, figs, oranges, lemons, tomatoes, tobacco, Indian corn, and the cereals. Much of the land produces two crops in the year.

The population of the territory in 1900 (official) was 122,212, with 27,000 registered voters. During 1900 1,461 miles of railroad were assessed, the total taxable property represented a valuation of \$33,782,466; the total debt, territorial, county, and city approximated \$3,000,000, and applications were made for leave to enter upon a total of 501,797 acres. The copper output equaled 75,000 tons, the gold mined was valued at \$3,500,000, and the silver at \$2,590,000. The estimated population (1902) is over 125,000, of whom more than 12,000 belong to the Mormon Church.

The principal cities are Phoenix, the territorial capital, Tucson, Globe, Prescott, Yuma, Jerome, and Flagstaff. Prescott is located in Yavapai, one of the largest and wealthiest counties in the territory, containing many highly cultivated farms and real and personal property valued in the aggregate at more than five and one-half millions of dollars. The cities are well built in modern style, and the population and material interests of the territory are steadily increasing in number and importance.

ARK OF NOAH, the vessel constructed by Noah for preservation from the approaching deluge. See NOAH.

ARK OF THE COVENANT, ARK OF THE REVELATION, are the full names of the sacred chest of acacia wood, overlaid with gold, which occupied the holiest place in the tabernacle and temple, and through which the idea of the constant presence of the covenant of God with the people of Israel received symbolical expression. The Old Testament religion conceived of God as spiritual, and so could not think to secure His presence by the use of images.

ARKADELPHIA, the county seat of Clark county, Arkansas, is eligibly situated on the west bank of the Ouachita river, also on the Arkansas division of the St. Louis, Iron Mountain and Southern road. It is the center of an extensive cotton producing area, and one of the most important shipping points for that staple in the State. The city contains two banks, three weekly papers, six churches, graded schools; being also the location of a college conducted under the auspices of the Baptist denomination, cotton mills, saw mills,

salt works, sash, door and blind factories, foundries, hotels, and public halls. Population (1900), 2,739.

ARKANSAS (pronounced Arkansaw), one of the southwestern States of the Union, has an area of 53,045 square miles, or nearly 33,500,000 acres. It is bounded north by Missouri, east by Tennessee and Mississippi, from which it is separated by the Mississippi River, south by Louisiana, and west by the Indian Territory. It belongs to the great basin of the Mississippi, being watered by that river, and by several of its main tributaries, which are all more or less navigable. Of these the principal are the St. Francis, in the northeast; the White River and its affluents, the Cache, Little Red, and Black Rivers in the north; and notably the Arkansas, which, entering the State at Fort Smith, traverses it in a southeasterly direction until it joins the Mississippi. The southern part of the State is watered by the Washita in the east, and by a bend of the Red River in the west. There are 3,800 miles of river steamboat navigation. Westward the country gradually attains a greater elevation, passing off into hills and undulating prairies, which lead up to the Ozark Mountains, beyond which again an elevated plain stretches toward the Rocky Mountains.

About 32 per cent. of the tillable land of the State is cultivated and less than 5 per cent. of the whole area can be denominated non-fertile. For soil classification the State may be divided into four grades. First comes the alluvial or valley soil that aggregates about 6,000,000 acres. This extends all along the river courses and is rich in all mineral and vegetable elements necessary to the growth of cotton, cereals, vegetables, and fruits. The uplands, or rolling, hilly plateaus contain about 16,000,000 acres, and are well timbered. Corn, wheat, oats, fruits and some cotton are grown here. The mountain country is heavily timbered and of picturesque appearance, while the valleys are fertile. The prairies are confined to three counties, the principal production being the grasses, fruits, cotton, and corn. Arkansas is pre-eminently an agricultural State, its rural population being larger in proportion than that of any other State of the Union.

The territory which is now included in Arkansas was first explored by DeSoto in 1541. Marquette and Joliet visited it in 1673, and Hennepin and LaSalle came later. In 1686 Tonty formed the first white settlement at Arkansas Post. The country formed a part of Louisiana, and was owned in succession by France and Spain, and was acquired by the United States by purchase in 1803. [See LOUISIANA, Vol. VII., page 3971.] Arkansas became a Territory of the United States in March, 1810, and was admitted as a State on June 15, 1836. By 1860 its population had increased to 435,450. It joined with its neighbors in the formation of the Confederacy and was the scene of several destructive campaigns during the Civil War. In 1870 the population was 481,451, but in 1880 with the return of peace and the development of industry it had increased to 802,525, and the census returns for the year 1900 gave it a population of 1,311,564.

Arkansas is rich in minerals, the coal product in 1900 being 850,000 tons. The mineral products are reported to be very considerable, "including zinc, manganese, iron, lead, and copper; marble, whet and hone stones, rock-crystal, paints, niter-earths, kaolin, granite, freestone, limestone, marls, greensand, marly limestones, grindstones, and slate." The zinc ores are said to compare very favorably with those of Silesia, while the argentiferous galena produces a high average percentage of silver. Of coal, anthracite and lignite, there are abundant supplies. A great number of mineral and thermal springs occur in various parts of the State, the most re-

markable and most frequented groups lying to the south of the Arkansas in Hot Springs county.

Within the past few years a new geological survey has been made, the result being the discovery of immense deposits of manganese, zinc, nickel, various kinds of building stone, gypsum, marl, and coal. The manganese belt extends through fifteen counties and the coal-fields cover an area of 2,500,000 acres. In 1899 the output of cotton was 709,880 commercial bales.

The manufacturing interests of the State, for a long time neglected, have experienced a considerable development during the past decade. In 1889 160 charters of manufacturing and trading companies, representing a capital of \$27,184,600, were issued. Returns made in 1900 showed a total of 4,794 corporated institutions, with an aggregated capital of about \$36,000,000, and employing 26,000 hands, and since that time the growth has been rapid and constant. In 1860 there were only thirty-eight miles of railroad in the State, now there are 3,155 miles. Arkansas has few cities; its capital is Little Rock, situated about the center of the State. Pop. (1900), 38,307.

There is great variety of soil in Arkansas. Along the river "bottoms" the alluvium is dark, rich, and deep, and yields excellent crops. The chief crops cultivated are maize, wheat, cotton, and tobacco, as well as apples and other fruits. The trees and shrubs most frequently occurring are poplars, oaks, pines, sweet-gum, sycamore, black locust, ash, elm, hickory, dogwood, elder, palma christi, black spice, pawpaw, mockernut, wild vine, etc. The value of the pine product in 1889 was \$15,168,000.

Arkansas live stock interests are flourishing. The country is well-watered, its climate is favorable for stock-raising and the nutritious grasses abound. Returns of 1900 show the number and value of live stock in that year as follows:

	No.	Value.
Horses.....	253,590	\$10,164,495
Mules.....	175,001	9,989,704
Oxen and other cattle.....	581,958	5,535,826
Milch cows.....	312,577	6,349,801
Sheep.....	256,929	437,317
Hogs.....	1,713,307	2,981,309

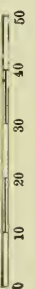
The school system is under the direction of a State superintendent and subordinate officials. In addition to upward of 5,350 school-houses distributed throughout the State, a normal school is conducted at Pine Bluff, and an industrial university at Fayetteville. At the opening of the school year in 1899 there were 301,387 pupils enrolled, 5,820 teachers employed, and the school property was valued at \$2,565,000 on October 1, 1899. The tax for school purposes is seven mills in addition to the poll tax. The State maintains schools for the blind and deaf and dumb, and has at present a total of about 1,200,000 acres of State lands of various descriptions remaining unsold. The actual enrollment of school children in 1889 was over 400,000, and the total expenditures for school purposes were \$1,143,000. Separate schools are provided for the different races.

The financial condition of Arkansas has greatly improved of late years. Taxation is limited by constitutional provision; the limitation for State purposes being 1 per cent.; county, $\frac{1}{2}$ of 1 per cent.; city, $\frac{1}{2}$ of 1 per cent.; all special school tax, $\frac{1}{2}$ of 1 per cent.; all of which is based on an assessment of one-third of the true value. The total indebtedness is \$4,768,895, of which more than half consists of the school funds held in trust. Since 1881 over \$1,700,000 of the bonded debt has been redeemed. The taxable property returned for assessment in 1889 was over \$170,000,000.

ARKANSAS, a river in the United States, which

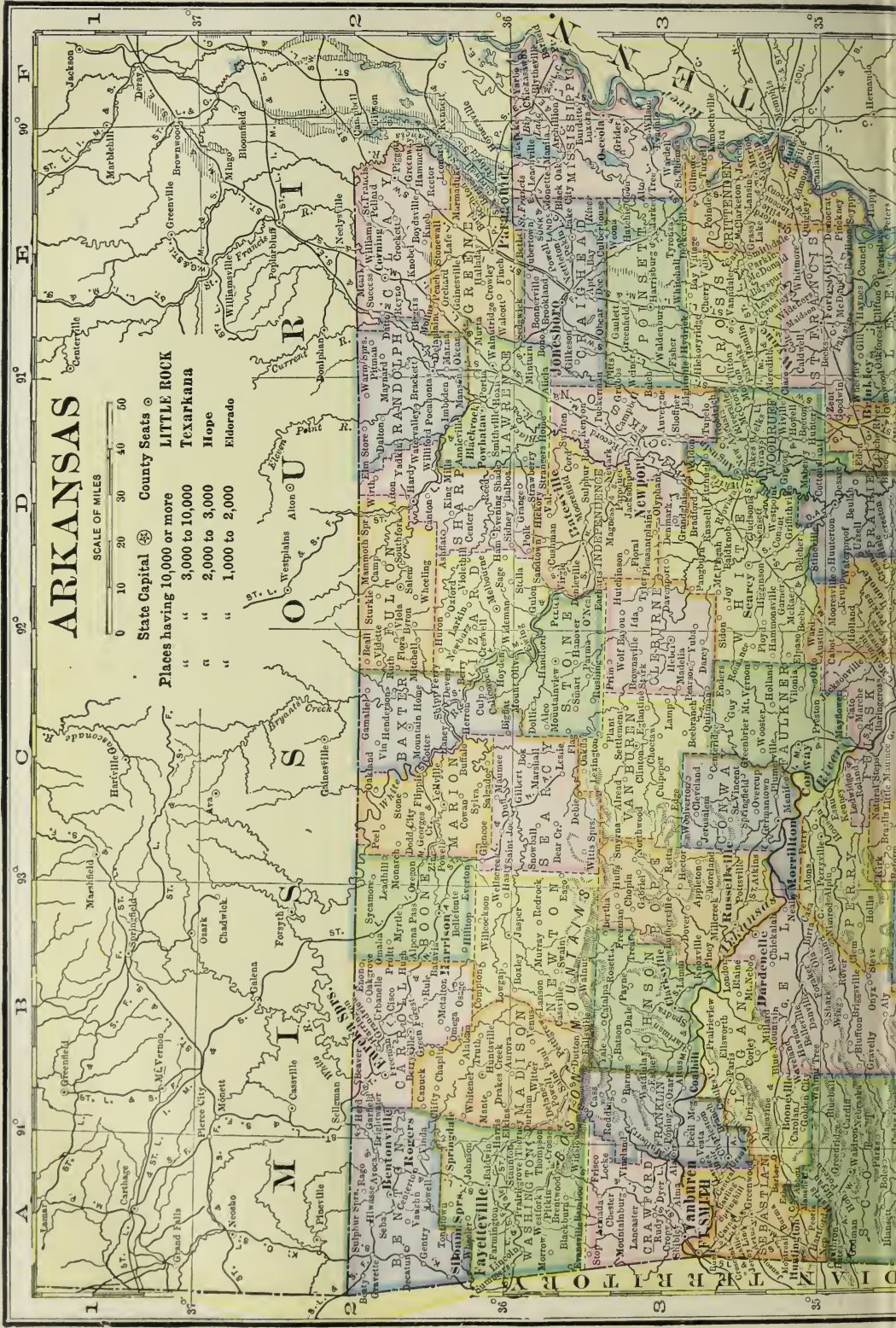
ARKANSAS

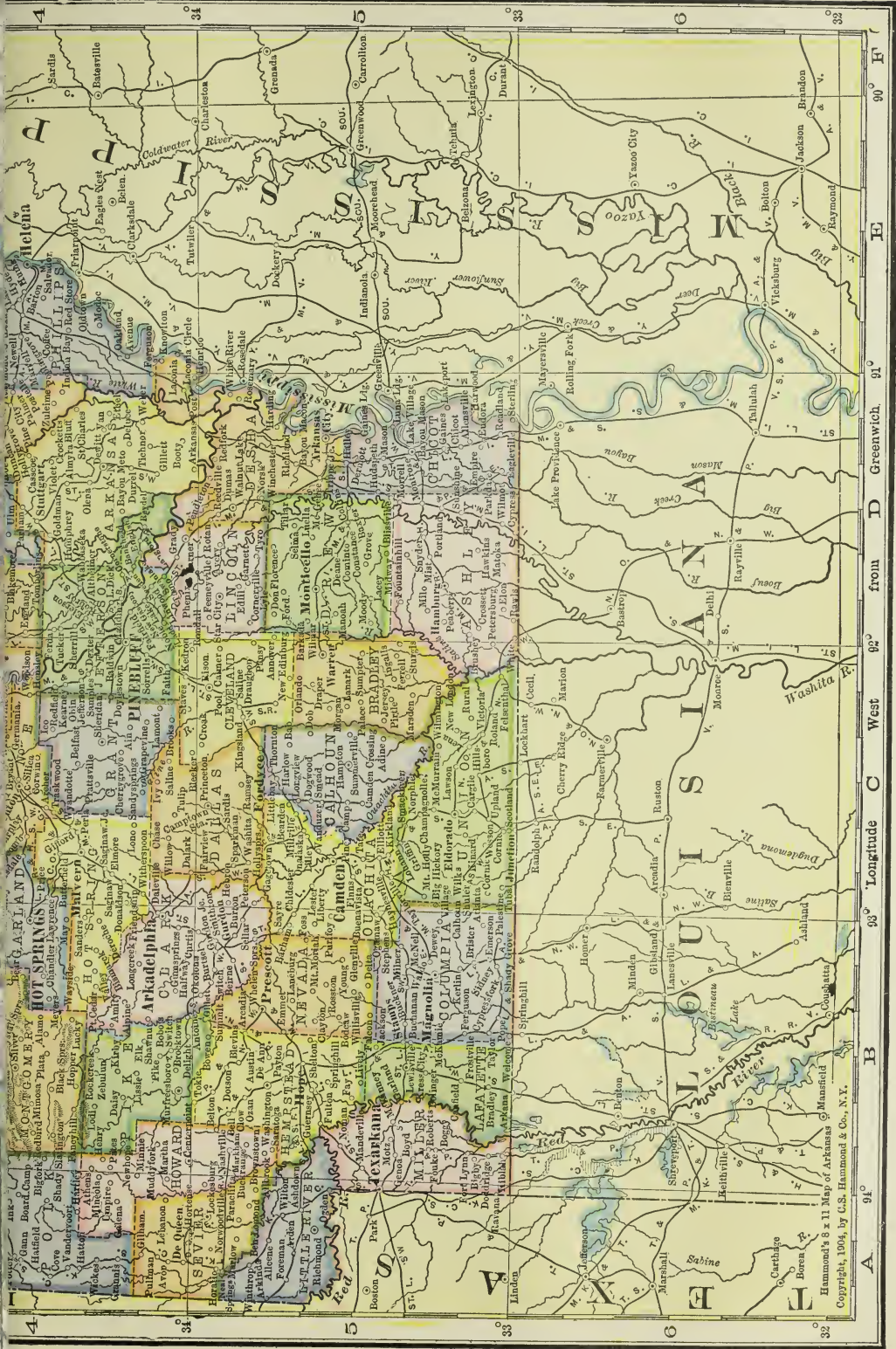
SCALE OF MILES



State Capital County Seats
Places having 10,000 or more
" " 3,000 to 10,000
" " 2,000 to 3,000
" " 1,000 to 2,000

LITTLE ROCK
TEXARKANA
Hope
Eldorado





Hamond's 8 x 11 Map of Arkansas © Mansfield
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risers in the Rocky Mountains, in lat. 39° N., long. 106° W., 10,000 feet above the level of the sea, flows with a generally eastward direction through Colorado and part of Kansas, then turns to the southeast, and so proceeds through the rest of Kansas, the northeast part of the Indian territory, and the State to which it gives its name, and finally falls into the Mississippi at a point near the former site of Napoleon, in lat. $33^{\circ} 40'$ N. The length of its course is stated at 2,170 miles, and its drainage-area at 178,000 square miles. It receives a large number of tributaries, of which the most important are the Cimarron, Rio Nutria, and Canadian rivers.

ARKANSAS CITY, a rapidly growing city in the southern portion of Cowley county, Kansas, is situated at the junction of the Walnut and Arkansas rivers a short distance from the Indian Territory. It is a railroad center of considerable importance and a supply depot for the trade of the Indian Territory and the Oklahoma country. The Atchison, Topeka and Santa Fe, Missouri Pacific, and St. Louis and San Francisco roads pass through the city and afford abundant facilities for shippers and travelers. There corporations have also made valuable improvements here, and have been important agencies in the development of prosperity in the surrounding country, which is largely devoted to agriculture and cattle raising. One daily and two weekly papers are published in the city, and six banks are successfully conducted. It also contains churches, schools, etc., six hotels, an opera house and public halls, besides commercial and manufacturing enterprises in large number, many of the latter being operated by water power, of which an abundance is available. The city is lighted by gas and electricity, provided with water-works and is in all respects progressive. Population, 6,140 in 1900.

ARKLOW, a seaport and market town in the county of Wicklow, Ireland, fifty miles from Dublin, the inhabitants of which are principally engaged in the fisheries and in copper mines. Population about 6,500.

ARKWRIGHT, SIR RICHARD, famous for his inventions in cotton spinning, was born at Preston in England, in 1732, of parents in humble circumstances.

The *spinning-jenny*, invented in 1767 by Hargraves, a carpenter at Blackburn in Lancashire, gave the means of spinning twenty or thirty threads at once with no more labor than had previously been required to spin a single thread. The thread spun by the jenny could not, however, be used, except as weft, being destitute of the firmness or hardness required in the longitudinal threads or warp. But Mr. Arkwright supplied this deficiency by the invention of the *spinning-frame*, which spins a vast number of threads of any degree of fineness and hardness. It is not difficult to understand the principle on which this machine is constructed, and the mode of its operation. It consists of two pairs of rollers, turned by means of machinery. The lower roller of each pair is furrowed or fluted longitudinally, the upper one is covered with leather, to make them take a hold of the cotton. If there were only one pair of rollers, it is clear that a carding of cotton, passed between them, would be drawn forward by the revolution of the rollers; but it would merely undergo a certain degree of compression from this action. No sooner, however, has the carding, or *roving* as it is technically termed, begun to pass through the first pair of rollers, than it is received by the second pair, which are made to revolve with (as the case may be) three, four, or five times the velocity of the first pair. By this ingenious contrivance the roving is drawn out into a thread of the desired degree of tenacity, a twist being given to it by the adaptation of the

spindle and fly of the common flax wheel to the machinery. Such is the principle on which Arkwright constructed his famous spinning-frame.

Arkwright's *first* patent for spinning by rollers, which is the essential part of his inventions, was obtained, according to the account given, in 1769; and its value and importance were no longer doubtful after the establishment of the factory at Cromford in 1771. The success which attended this novel method of spinning naturally excited the strongest desire on the part of the Lancashire manufacturers to participate in the advantages to be derived from it; and the fair presumption is that, instead of attempting clandestinely to pirate the invention, they would, had they conceived there were any good grounds to go upon, have at once contested the validity of the patent. But no such attempt was made till 1781, *twelve* years after the date of the first patent, and *six* years after the date of the second. And even then, Arkwright's opponents came forward only in consequence of his having resolved to vindicate his rights, which had begun to be invaded on all sides, by raising an action against Colonel Mordaunt for an infringement on his patent. Mordaunt was supported by a combination of manufacturers and, as they felt the question to be of the greatest importance, it is all but impossible to suppose that anything would be omitted on their part which was conceived likely to contribute to their success. The case having been tried in the Court of King's Bench, after Trinity term, July, 1781, the decision was unfavorable to Arkwright.

But in a new trial (Arkwright v. Nightingale), which took place in the Court of Common Pleas on the 17th of February, 1785, Lord Loughborough, the presiding judge, having expressed himself favorably with respect to the sufficiency of the specification, a verdict was given for Arkwright. On this, as on the former trial, nothing was stated against the originality of the invention.

On their introduction, Arkwright's machines were regarded by the lower classes as even more adverse to their interests than those of Hargraves, and repeated attacks were made on the factories built for them. But however extraordinary it may appear, it was amongst the manufacturers that the greatest animosity existed against Arkwright; and it required all the prudence for which he was so remarkable to enable him to triumph over the powerful combination that was formed against him. At the outset of the business they unanimously refused to purchase his yarn; and when his partners, Messrs. Strutt and Need, had commenced a manufacture of calicoes, the manufacturers strenuously opposed a bill to exempt calicoes from a discriminating duty of 3d. a yard laid on them over and above the ordinary duty of 3d. by an old Act of Parliament. Luckily, however, the manufacturers failed of their object; and, in 1774, an Act of Parliament was obtained (14 Geo. III. cap. 72) for the encouragement of the cotton manufacture, in which fabrics made of cotton are declared to have been *lately* introduced, and are allowed to be used "a lawful and laudable manufacture;" the duty of 6d. the square yard on such cottons as are printed or stained being at the same time reduced to 3d. But this disgraceful spirit of animosity, which must, had it been successful, have proved as injurious to the interests of the manufacturers as to those of Arkwright, did not content itself with actions in the courts of law, or a factious opposition to useful measures in Parliament, but displayed itself in a still more striking and unjustifiable manner. A large factory, erected by Arkwright at Birkacre, near Chorley, in Lancashire, was destroyed by a mob collected from the adjacent country, in the presence of a powerful body of police and military,

without any one of the civil authorities requiring them to interfere to prevent so scandalous an outrage.

Fortunately, however, not for himself only, but for his country and the world, every corner of which has been benefited by his inventions, Arkwright triumphed over every opposition. The same ingenuity, skill, and good sense, which had originally enabled him to invent his machine and get it introduced, enabled him to overcome the various combinations and difficulties with which he had subsequently to contend.

Though a man of great personal strength, which he is said to have displayed, when young, in election riots at Preston. Arkwright never enjoyed good health. During the whole of his memorable career of invention and discovery, he was laboring under a very severe asthmatic affection. A complication of disorders at length terminated his truly useful life in 1792, at his works at Cromford, in the sixtieth year of his age. His inventions have opened a new and boundless field of employment; and while they have conferred infinitely more real benefit on his native country than she could have derived from the absolute dominion of Mexico and Peru, they have been *universally* productive of wealth and enjoyment.

ARLES (*Arelate*), a city of France in the department of Bouches du Rhône, forty-six miles northwest of Marseilles. It stands on the left bank of the Rhone, where that river divides. Population, 15,000.

Arelate was an important town at the time of Cæsar's invasion, and subsequently received a Roman colony, and became under the later emperors one of the most flourishing towns on the further side of the Alps. It was plundered in 1730 by the Saracens, but in the 10th century became the capital of a kingdom of the same name formed by Bozon from the two kingdoms of Burgundy. In the 12th century it was a free city, governed by *consuls* and *podestas* after the model of the Italian republics. In 1251 it submitted to Charles of Anjou, and from that time onward followed the fortunes of Provence. Arles still possesses many monuments of Roman architecture and art, the most remarkable being the ruins of an amphitheatre (*arenæ*), capable of containing 20,000 spectators.

ARLINGTON, a town of Alexandria County, Va., a few miles from Washington City, on the opposite bank of the Potomac. Close by lies the famous "Arlington Heights," the country-seat of Gen. R. E. Lee, which was confiscated by the government after the war, but was restored to his family subsequently.

ARLINGTON, a thriving town of Middlesex county, Mass., is located in Arlington township, seven miles northwest of Boston, on the Middlesex railroad. It was formerly known as West Cambridge, adopting the present name in 1867. The town is handsomely laid out, and contains many attractive and elegant residences and public edifices of more than ordinary pretensions. There are six churches in Arlington, one weekly paper, one bank and a number of manufactories of drugs, piano cases, ice tools, etc. The population is 8,603 (1900).

ARLON (*Orolaunum* in the Antonine Itinerary), the capital of the Belgian province of Luxemburg, is situated on rising ground in the midst of a well-cultivated plain. In the neighborhood was the nunnery of Clairefontaine or Bardenburg, established about 1216, which is now a foundry. Population about 8,000.

ARMADA, a Spanish word, meaning generally an armed force or fleet, is applied specially to designate the great expedition sent out against England in 1588 by Philip of Spain. His principal motive for this enterprise was the desire to strike a decisive blow at the Protestant faith, of which England was then the bulwark. For many months the whole energies of the

Spanish nation had been directed toward the construction and equipment of the requisite ships. In 1587 everything was nearly ready, but the sailing of the expedition was delayed for a year by Drake who made a bold dash into the harbor of Cadiz and destroyed nearly a hundred ships, with immense stores of provisions. A further delay was caused by the sudden death of the marquis of Santa Cruz, who had been originally intrusted with the chief command. His loss was a serious blow to the Spanish cause, for he was an experienced sailor. The duke of Medina Sidonia, a man almost entirely ignorant of naval affairs, was then made admiral. All preparations being at length completed, the great fleet sailed from Lisbon on the 29th (19th o.s.) of May, 1588. It consisted of 129 large vessels, and carried 19,295 soldiers, 8,460 sailors, besides slaves as rowers, and 2,431 cannon. Their destination was the coast of Flanders, where Alexander Farnese, prince of Parma, was lying with about 35,000 men and a flotilla of boats. This force was to be landed on the Isle of Thanet at the mouth of the Thames, under the protection of the Armada, which would be able to keep the channel perfectly clear. Another body of troops was then to be landed further north; and it had been hoped at one time that the duke of Guise would effect a diversion by landing a force on the west coast. These plans, however, were considerably deranged by the length of time occupied in preparing the expedition, and by the further delays encountered. For the fleet had scarcely sailed from Lisbon, when it was overtaken by a severe storm, which shattered several of the ships, and compelled them all to put in for repairs at Coruña. It was on the 22d (12th) July before they finally sailed from Spain. England meanwhile had not been idle; when the news arrived that the great expedition was really about to set out, the most intense enthusiasm took possession of the people, who gladly furnished ships and stores, and raised volunteer bands for coast defense. The command of the army was given to the earl of Leicester, who took his post, with about 16,000 men at Tilbury to oppose the landing of Parma. About 45,000 were assembled round the queen, to protect her person. The royal navy, which consisted of about thirty ships, was at once put in order, and gradually increased, by the addition of merchantmen and privateers, to about 180 vessels. These carried about 18,000 sailors, but they had not half the weight of the Spanish artillery, and they were scantily supplied with ammunition and provisions. The ships, however—those of the queen in particular—were in splendid order, and the sailors were the finest in England. The lord high admiral was Lord Howard of Effingham, who had under him Drake, Hawkins, Frobisher, and others, the most celebrated mariners of the age. He took his station with the main body of ships, about eighty in number, at Plymouth, and another squadron, under Lord Seymour, cruised off Dunkirk, commanding the straits and blockading the prince of Parma. Meantime, news was brought to England that the Armada had encountered severe storms, and that the expedition was given up. So much faith was put in this report that several ships began to discharge their crews. Howard, however, sailed down toward Coruña, and discovered that the report had no foundation. On the 29th (19th) July, the fleet was observed entering the Channel, and the beacon-lights along the coast gave warning to England that the dreaded enemy was at hand. That evening Howard's ships were moored so as to be able to slip out of Plymouth Sound at a moment's notice. On the following day the Armada was seen standing up the Channel in the form of a crescent, seven miles long, and numbering 150 ships. They passed Plymouth to-

wards evening, and during the night the English fleet sailed out of the Sound, and took up a position to windward. On the following day the action began by the duke of Medina Sidonia attempting to close and come to a general engagement. But he found this to be impossible; the English ships, light and admirably handled, sailed so swiftly, and were manœuvred with such dexterity, that it was out of his power to inflict any injury on them. Their fire also was rapid and deadly, while the Spanish guns were worked slowly, and generally sent the shot far over the light English vessels. Dismayed at their want of success, the Spanish fleet stood off up the Channel, closely pursued by the English. Throughout all the next week the same tactics were pursued; the English, hovering on the rear of the Armada, harassed and weakened it without coming to a general engagement. At length, on the 6th August (27th July), Medina Sidonia cast anchor in the roads of Calais, and sent messengers to the prince of Parma, asking him for ammunition and light vessels, and suggesting that he should now attempt his landing on the coast of England. But the prince declared that it was impossible to cross the Channel while the English fleet was on the sea, that he had no light ships, and that the state of the weather prevented him sending such ammunition as he could spare. Lord Howard had now been joined by Seymour's squadron and by many private ships, but he and the other commanders were still in the deepest anxiety. They were almost destitute of provisions and powder, and did not yet know what damage they had inflicted on the Armada, which, after all their endeavors, seemed now to have reached its destination. At last it was resolved to drive the Spanish fleet out into the open sea, and to effect this by means of fire-ships. Eight ships were selected and filled with combustibles, their rigging was smeared with pitch, and on the night of the 7th August (28th July) they were drifted down with the tide and set on fire. The Spaniards, in great alarm, immediately cut their cables and cleared off from the shore. Next morning Drake pursued them, while Howard remained for some time to attack a galleon that had gone ashore during the night. The Spanish fleet was scattered over a large space off Gravelines, and Drake at once began the action, driving them together into a confused mass by his rapid firing and swift manœuvring, and forcing the whole towards the coast of Flanders. Had his ammunition held out he might have completed the ruin by driving them on shore; as it was, the injury inflicted by this one day's fighting was enormous. Nearly 4000 men were killed and many ships were disabled, and the hopes of the Spaniards were broken. Their courage completely deserted them; and next day, when a council of war was held, it was resolved to try the perilous voyage to Spain by the North Sea and Pentland Firth rather than again face Drake and the English fleet. The whole fleet, still numbering 120 vessels, stood off accordingly towards the North Sea. Drake and Howard pursued for some days, till want of provisions compelled them to return. But the weather proved a sufficiently formidable enemy to the unhappy Spaniards. The continuous violent gales which accompanied them along their route, by the north of Scotland and the wild Irish coast, completely shattered their unseaworthy vessels. The shores were strewn with wrecks, and many hundreds of unfortunates who were saved from the sea were slain by the Irish. Constant sickness had decimated the troops, and when at length, in September and October, fifty-four shattered vessels reached Spain, they conveyed only 9000 or 10,000 men, and these were in a pitiable state from sickness and want.

ARMADILLO, a family of South American mammals (*Dasyptidae*), belonging to the order Edentata, and distinguished by the peculiar nature of their external covering. This consists of a bony case, partly composed of solid buckler-like plates, and partly of movable transverse bands, the latter differing in number with the species, and, to a certain extent, with the age and sex of the individual, and giving to the entire body a considerable degree of flexibility. The under parts are destitute of bony covering, but in every case are more or less thickly covered with hair. The legs of the armadillo are short, and its movements usually slow, although, when pursued, it is said to be able to outrun a man. In danger, however, it chiefly depends for safety on its long, powerful claws, by which it can bury itself, in a few minutes, several feet below the surface of the ground. Most of the species are nocturnal in their habits, with small, weak eyes, but highly developed organs of hearing and smelling.

ARMAGH, an inland county of Ireland in the province of Ulster, comprising an area of 328,086 statute acres, of which 178,064 are under tillage, 100,137 in pasture, 4670 in plantation, and 28,177 in waste, &c., while 17,038 acres are under water. It is bounded on the N. by Lough Neagh, on the E. by the county of Down, on the S. by Louth, and on the W. by Monaghan and Tyrone. The general surface of the county is gently undulating and pleasingly diversified; but in the northern extremity, on the borders of Lough Neagh, is a considerable tract of low, marshy land, and the southern border of the county is occupied by a barren range of hills, the highest of which, named Slieve Gullion, attains an elevation of 1893 feet, being the highest mountain in Ulster excepting Slieve Donard in the county of Down. The summit of Slieve Gullion, commanding one of the finest prospects in the province, is crowned by a large cairn or pile of stones, which forms the roof of a singular cavern of artificial construction. In the western portion of the county are the Few Mountains, a chain of abrupt hills mostly incapable of cultivation.

The soil of the northern portion of the county is a rich, brown loam, on a substratum of clay or gravel, with an abundance of limestone near Armagh and other places. Towards Charlemont there is much reclaimable bog resting on a limestone substratum. The eastern portion of the county is generally of a light friable soil; the southern portion rocky and barren, with but little bog except in the neighborhood of Newton Hamilton. The climate of Armagh is considered to be one of the most genial in Ireland, and less rain is supposed to fall in this than in any other county.

The total population in 1821 amounted to 197,427 souls. In 1831 the population was 220,134, and in 1841 it was 232,393, but in 1851 the numbers had declined to 196,085, in 1871 to 179,260, and in 1901 to 125,238.

The land is in general but indifferently cultivated, yet owing to the occupation of the peasantry in the linen manufacture they are better lodged, clothed, and fed than in most other parts of Ireland. The cultivation of grain has been for some time slightly on the decrease, and the number of acres under flax diminished from 27,245 in 1866 to 7530 in 1887; but in the green crops there has been considerable increase.

The farms are in general very small, and show less tendency to decrease in number than in most other parts of Ireland. In 1887 there were 6220 holdings of less than five acres each.

The principal manufacture, and that which has given a peculiar tone to the character of the population, is still that of linen, though it has somewhat declined of late. It is noways necessary to the promotion of this

manufacture that the spinners and weavers should be congregated in large towns, or united in crowded and unwholesome factories. On the contrary, most of its branches can be carried on in the cottages of the peasantry. The men devote to the loom those hours which are not required for the cultivation of their little farms; the women spin and reel the yarn during the intervals of their other domestic occupations.

ARMAGH, a city and parliamentary borough in the above county, 64 miles north of Dublin. It derives its name of *Ard-macha*, or High-Field, from its situation on the sides of a steep hill called Drumsailech, or the Hill of Willows, which rises in the midst of a fertile plain. Of high antiquity, and, like so many other Irish towns, claiming to have been founded by St. Patrick, it long possessed the more important distinction of being the metropolis of Ireland; and, as the seat of a flourishing college, was greatly frequented by students from other lands, among whom the English and Scotch were said to have been so numerous as to give the name of Trian-Sassanagh, or Saxon Street, to one of the quarters of the city. Of a synod that was held here as early as 448, we have interesting memorials in the *Book of Armagh*. Population about 9,000.

ARMAGNAC, a district of the south of France, corresponding to a large part of the present department of Gers, with portions of the neighboring territory, erected in the 10th century into a countship in favor of Bernard the Squint-eyed (le Louche), son of the count of Fezinsac. The family thus founded at various times exercised great influence on the destinies of France, especially in the persons of John I. (d. 1373), Bernard VII. (d. 1418), John IV. (d. 1451), and John V. (d. 1473). James of Armagnac, grandson of Bernard VII., was made duke of Nemours in 1462, and was succeeded in the dukedom by his second son, John, who died without issue, and his third son, Louis, in whom the house of Armagnac became extinct in 1503.

ARMENIA (*Hayasdani* or *Haikh*, in the native language), formerly an extensive country of Western Asia, which is now divided between Turkey, Russia, and Persia. Its political relations, and consequently its geographical limits, were subject to frequent variation, but in its widest extent it may be described as reaching from the Caucasus in the N. to the Mountains of Kurdistan in the S., and from the Caspian Sea in the E. to Asia Minor in the W., frequently, indeed, somewhat overlapping with the last-mentioned geographical division. From a very early period a distinction was drawn between Greater Armenia (*Armenia Major*, *Medz Hayotz*) to the east of the Euphrates, and Lesser Armenia (*Armenia Minor*, *Phokhr Hayotz*), lying to the west. The former is more properly Armenia. It consists for the most part of an elevated table-land, about 7000 feet above the level of the sea, culminating in the peaks of Mount Ararat, and sinking towards the plains of Iran on the east and those of Asia Minor in the west, while it is frequently broken by glens and valleys. It is watered by the Euphrates, the Tigris, the Aras, and the Kur, all of which have their sources within its borders; and, like other mountainous countries, it possesses a large number of lakes. The most important of these are Van or Aghtamar, Sevan or Khabodan, and Armiyah or Keghem. The country is naturally fertile, producing grain, cotton, tobacco, and grapes, but for many centuries it has been sadly neglected. It abounds in romantic scenery and luxuriant pasture. The beauty of the district of Ararat especially has been celebrated by patriotic historians like Moses of Khorene and Lazarus of Pharb.

According to their own legendary history, in which ancient traditions are curiously incorporated with

Biblical lore, the Armenians are descendants of Haik, a son of Togarmah, the grandson of Japhet, who fled from the tyranny of Belus of Assyria and settled in the country which now, in their language, bears his name. The conquest of the land by Semiramis, and the revolt of Barvir against Sardanapalus, are the chief events in the early ages. Tigranes or Dikran is regarded as the contemporary and ally of Cyrus, and the history of his reign is recorded in detail. His son, Vahakin, who succeeded him, was celebrated for his strength, and was deified after his death. The dynasty came to an end in the person of Vahi, who was defeated by Alexander the Great, 328 B.C.

The Armenians threw off the Macedonian yoke in 317 B.C., and chose Ardvates as their king; but on his death, about thirty-three years afterwards, they submitted to the Seleucids of Syria. About 190 B.C., Artaxias, who had been appointed governor by Antiochus the Great, took advantage of that monarch's defeat by the Romans and proclaimed Armenia Major independent. It was this prince who afforded an asylum in his court to the exiled Hannibal. The example of revolt was followed in Lesser Armenia by Zadiades, whose descendants maintained their position till the time of Tigranes II., when their territory was annexed to Greater Armenia.

About the middle of the 2d century B.C., the great Parthian king, Mithridates I., who had already extended his empire over Syria, established his brother, Valarsaces (Wagharshag), in Armenia, and thus rendered him the founder of one of the most important branches of the Arsacid family. The new king greatly promoted the prosperity of the country by founding cities, establishing laws, and rewarding persons of talent. The most celebrated of his successors was his great-grandson, Tigranes II., who made himself master of Syria, the Lesser Armenia, and many Parthian provinces, and would, probably, have been the founder of an extensive empire had not the solicitations of his father-in-law, Mithridates of Pontus, brought him into collision with the Romans. In reward for the submission which he ultimately made to Pompey, he was allowed to keep possession of Armenia, with the exception of the provinces of Sophene and Gordyene, which were erected into a separate kingdom for his son, Tigranes. He continued a faithful ally of the Romans till his death, about 55 B.C., when he was succeeded by his son, Artavasdes, who, having adopted a more independent policy, was taken prisoner by Antony and carried to Alexandria, where he was afterwards beheaded by Cleopatra in 30 B.C.

A period follows of nominal Roman supremacy and actual anarchy; 170 independent families all asserting themselves to the best of their ability, and a few of them succeeding in establishing their petty principalities. At length a usurper, Erovant, an Arsacid by the female line, made himself in some sort master of all the kingdom about 58 A.D., and maintained his position till he was expelled by Ardashes (Exedarus), a more direct representative of the race, who was repeatedly dethroned and restored by Parthian and Roman interference, but managed to do something for the amelioration of his country.

When the Arsacids were driven from the Persian throne by the Sassanid Artaxerxes (Ardeshir), Chosroes the Great of Armenia naturally took up arms in their defence; and he maintained the contest till his assassination by Anag, an Arsacid prince of Persia, when Armenia became subject to the Persian dynasty, 232 A.D. In the massacre of the royal family which ensued, none escaped but Tiridates (Tirdat), a son of Chosroes, who fled to Rome, and afterwards, with the help of the Romans, established himself on the throne,

259 A.D. The first act of his reign was the persecution of the Christians, who had begun to take root in the country during the previous century. St. Gregory, surnamed the Illuminator, was cast into prison; but the king being, as he supposed, miraculously cured of a dangerous distemper by the saint, the Christian religion was embraced by himself and most of his people. The introduction of Christianity tended to arouse the animosity of the Persians; and from this period Armenia became the theatre of almost uninterrupted struggles between that nation and the Romans, until Theodosius the Great agreed to cede to Persia the eastern part of the country, which was thence called Persarmenia, while the western part was annexed to the Roman empire. Theodosius nominated Arsaces IV., then nominal king of Armenia, governor of the western division; and the Persian king, to conciliate the people, appointed Chosroes III., a descendant of another branch of the Arsacids, governor of the eastern part. The rule of the Arsacids in Persarmenia ended with Ardashes IV., who was dethroned by Bahram V. of Persia in 428; and from that date Armenia ceased to be a kingdom, and was ruled till 632 by Persian *marzbans* or governors. The Persians had all along endeavored to subvert Christianity, and for that purpose had recourse to the most cruel persecutions. Frequent insurrections were the consequence, one of the most remarkable being that which was led by Vartan (see Neuman's *History of Vartan*, by *Elisæus*, 1830). From 632 till 839 Armenia was the scene of almost incessant struggles between the Greeks and Mahometans, while its own native princes added to the confusion by their rivalries and strife.

In 1604 Shah Abbas, in his contest with Ahmed I., laid the whole country waste, and forcibly transplanted about 40,000 of the inhabitants into Persia, where they settled principally in Ispahan and New Julfa, as they fondly called the city which they founded. Since then the Armenians have had no political position as a nation, though they continue to form an important and valuable portion of the population in Russia, Turkey, and Persia, and their colonies have spread into almost all quarters of the globe.

ARMENIAN CHURCH, THE, is one of the oldest Eastern Christian churches not in communion with the orthodox Greek Church or with the Church of Rome.

1. *History*.—This is divided into three periods, from 34 to 302 A.D., from 302 to 491, and from 491 to the present time. (1.) The first period is mainly legendary. The Church of Armenia claims an older than apostolic foundation. (2.) The historical founder of the Armenian Church was St. Gregory, called the "Illuminator." He was a prince of the reigning family of the Arsacidæ, who, having been converted to Christianity, was eager for the conversion of his countrymen. About 450 A.D. the Armenian Church suffered a severe persecution, which prevented any of the bishops being present at the fourth œcumenical council (Chalcedon, 451 A.D.), at which Eutyches and his followers, the extreme opponents of Nestorius, were condemned. The Armenian Church never accepted the decisions of the Council of Chalcedon, and, in 491 A.D., the patriarch, in full synod, solemnly annulled them. This act led to the separation of the Armenian from the orthodox Greek Church. (3.) The period of schismatic existence divides into three—(a), from 491 A.D. to the middle of the 15th century; (b), from the middle of the 15th to the middle of the 18th centuries; (c), from 1746 down to the present time. It is difficult to account for the schism of the Armenian Church; according to common report, the Armenians were Eutychians, and were virtually cut off from the church when the Council of

Chalcedon condemned that heresy, but their own account of the matter in their authoritative documents is very different.

2. *Doctrines*.—These are almost identical with those of the orthodox Greek Church. The Armenians accept the first three, and the fifth, sixth, and seventh œcumenical councils, denying that of Chalcedon only, but, as has been explained, they, in their authoritative documents, reject the Eutychian heresy, which that council was called to condemn.

3. The *Liturgy* is said to date from the 1st century, and to have been founded on that of the Church of Jerusalem. St. Gregory remodelled it, and introduced the Nicene Creed, using that edition which contains the damnatory clause, and adding a conclusion of his own.

4. *Sacraments*.—The Church of Armenia has the seven sacraments: baptism, confirmation, the eucharist, penance, ordination, marriage, and extreme unction.

5. *The Clergy*.—There is the threefold order—bishops, priests, and deacons; and there are three degrees of episcopal rank—the archbishops (chief among whom is the patriarch or catholicos), the bishop, and the vartabed, or doctor of theology, who has frequently charge of a diocese, with episcopal functions. The clergy are further divided into the black and the white.

ARMENIAN LANGUAGE. The Armenian or Haikan language is an offshoot of the Iranian branch of the Indo-Germanic family of languages. Its earlier stage is probably represented in the cuneiform inscriptions of Van, on which see Hincks, in *Jour. R. Asiatic Soc.*, vol. ix. (1848), and Mordtmann, in *Zeitschrift d. deutschen morgenl. Gesellschaft* (vol. xxvi. (1872)). The existing literature of the Armenians dates from the 4th century, and is essentially and exclusively Christian. The translation of the Old Testament by Sahag Bartelevatsi, and of the new by Miesrob, are among its oldest monuments. The dialect in which this version is written, and in which it is still publicly read in their churches, is called the old Armenian. The modern Armenian not only departs from the older form by dialectic changes in the native elements of the language itself, but also by the great intermixture of Persian and Turkish words, which has resulted from the conquest and subjection of the country, and by the character of inversion in the structure of its sentences. Of its two principal dialects,—the Western, spoken in Constantinople and Asia Minor, and the Eastern, spoken by the Armenians scattered over Tartary, Persia, and India,—the latter approaches more nearly to the idiom of the ancient language.

ARMENIAN LITERATURE. With the exception of a few fragments incorporated in later writers, the pre-Christian literature of Armenia has totally perished. The early Armenians seem to have possessed a body of traditional and historical songs analogous to the *Shah-nameh* of Persia, the memory of which lingered long among the common people, especially in the province of Koghten. Portions of these have been preserved by Moses of Khorene, and investigated by several modern scholars (see *Vebk Hnuin Hayasdanî*, i.e., *Chants hist. et pop. de l'ancienne Arménie*, J. B. Emin, Moscow, 1850; Dulaurier, *Rev. des D. Mondes*, 1852, vol. xiv.; "Etudes sur les chants hist. de l'anc. Arménie," in *Journal Asiatique*, 1852). With the introduction of Christianity a great development of literary activity took place, which chiefly expended itself, however, in translations from the Syriac and Greek. Armenian students were found in Athens and Byzantium, Alexandria and Rome, and some of them attained celebrity in their chosen pursuits. To this tendency we owe the preservation, in Armenian, of many works that have perished in their original languages.

The 12th and 13th centuries form a second great

period of Armenian literature, during which the influence of Syriac is again perceptible. Gregory Magistros, who introduced the Arabic system of versification into his native language, Narses of Lampron, Mekhitar Kosh, John Vanacan, Vardan the Great, Vahram, and Sempad, are a few of the numerous writers of note. From the 14th to the 18th century there is a falling off, the most important work, perhaps, being Thomas of Medzoph's *History of Timour*. In the 18th century a revival took place, which was mainly due to the Mekhitarists of Venice (see Langlois *Notice sur le couvent Arménien de l'île Saint-Lazare de Venise*, Paris, 1863), and since then Armenian literature has acquired a development which is remarkable in the absence of national unity.

ARMENIAN VERSION. The Armenian version of the Bible was undertaken in the year 410 by Miesrob, with the aid of his pupils Joannes Ecelensis and Josephus Palensis. It appears that the patriarch Isaac first attempted, in consequence of the Persians having destroyed all the copies of the Greek version, to make a translation from the Peshito; that Miesrob became his coadjutor in this work; and that they actually completed their translation from the Syriac. But when the above-named pupils, who had been sent to the ecclesiastical council at Ephesus returned, they brought with them an accurate copy of the Greek Bible. Upon this Miesrob laid aside his translation from the Peshito, and prepared to commence anew from a more authentic text. Imperfect knowledge of the Greek language, however, induced him to send his pupils to Alexandria to acquire accurate Greek scholarship; and, on their return, the translation was accomplished. Moses of Khorene, the historian of Armenia, who was also employed, as a disciple of Miesrob, on this version, fixes its *completion* in the year 410; but he is contradicted by the date of the Council of Ephesus, which necessarily makes it subsequent to the year 431.

ARMENTIERES, a well-built and flourishing town, in the department of Nord in France, on the Lys, nine miles northwest of Lille. Population (1889), 24,671.

ARMPFELT, GUSTAV MAURITZ, BARON, afterwards COUNT, eldest son of a Finnish nobleman, was born at Juva in 1757. He entered the army and gained the favor of Gustavus III., who appointed him to a post in the service of the Crown Prince, and afterwards made him general of a division of the army in the war against Russia. He was successful in his military operations, and also materially aided the king in quelling a conspiracy of the officers. In 1790 he signed the treaty of peace at Verela; and two years later, when Gustavus was mortally wounded by an assassin, Armpfelt was named by him governor of Stockholm. But the regent Charles, the late king's brother, was not well disposed towards him, and he took an opportunity to leave the country as ambassador to Naples. While there he entered into a conspiracy to depose the regent. This was discovered; he was outlawed and condemned to death, and his associates were severely punished. The accession of Gustavus IV. restored him to his honors, and after the revolution of 1809, by which the ex-regent became king, he was made president of the military council. Being suspected of having a share in the poisoning of the prince of Augustenburg, he fled from Sweden and took refuge at the Russian court, where he received the highest honors. He died in 1814 at Tzarskoe-Selo.

ARMINIUS (Ger. *Hermann* or *Herman*), a famous prince or chief of the German tribe Cherusci, was born 16 B. C. He conceived the plan of delivering the country from its oppressors, the Romans. All the tribes and leaders as far as the Elbe were secretly summoned;

Vurus, the Roman Viceroy, was lulled into security, and induced to despatch portions of his army to different points, and, with the remaining portion, consisting of three legions and some auxiliaries and cavalry, to quit the highway. He was thus lured into the impassable districts of the Teutoburg Forest in the north of Westphalia; an engagement took place, probably near Detmold, which lasted for three days. The result was the annihilation of the whole Roman army (9 A. D.). When intelligence of this defeat reached Rome, it excited the greatest consternation and anxiety. Augustus, who was now old and weak, is said to have yielded to transports of grief, repeating the words, "Varus, Varus, give me back my legions!" Germanicus in two successive campaigns, 14 A.D. and 16 A.D., reduced Arminius to great straits; and he being recalled to Rome by the Emperor Tiberius, 17 A.D., the results of his victorious activity were lost. From this time no Roman army ever ventured to penetrate from the Rhine into the interior of Germany, and this result must be ascribed chiefly to the Cheruscan prince. Nevertheless, no sooner was the foreign enemy expelled, than internal feuds broke out, in the course of which Arminius was slain by his own kinsmen, in the thirty-seventh year of his age.

ARMINIUS, JAMES, a distinguished Dutch theologian, author of the modified Reformed theology that receives from him its name, was born at Oudewater, South Holland, 1560. Arminius is a Latinized form of his family name, Hermanns or Hermannson. Theodore Æmilius, a priest who had turned Protestant, adopting James, removed with him to Utrecht, but died when his charge was in his fifteenth year. Rudolph Snellius, the mathematician, a native of Oudewater, then a professor at Marburg, happening at the time to visit his early home, met Arminius, saw promise in him, and undertook his maintenance and education. But hardly was he settled at Marburg, when the news came that the Spaniards had besieged and taken Oudewater. In February, the same year (1575), the university of Leyden had been founded, and was becoming a rallying point and nursery for the nascent literary genius, theological activity, and scholarship of the country. Arminius seized the opportunity thus afforded of pursuing his studies at home. The six years he remained at Leyden (1576-82) were years of active and innovating thought in Holland. The War of Independence had started conflicting tendencies in men's minds. To some it seemed to illustrate the necessity of the state tolerating all. Richard Koornhert argued in private conferences and public disputations, that it was wrong to punish heretics, and his great opponents were, as a rule, the ministers. In 1582 Arminius went to Geneva, studied there awhile under Theodore Beza, but had soon, owing to his active advocacy of the Ramist philosophy, to remove to Basle. After a short but brilliant career there he returned to Geneva, studied for three years, traveled, in 1586, in Italy, heard Zarabella lecture on philosophy in Padua, visited Rome, and, open-minded enough to see its good as well as its evil, was suspected by the stern Dutch Calvinists of Popish leanings. Next year he was called to Amsterdam, and there, in 1588, was ordained to the ministry. He soon acquired the reputation of being an elegant preacher and faithful pastor. He was commissioned to organize the educational system of the city, and is said to have done it well. He greatly distinguished himself by fidelity to duty during a plague that devastated Amsterdam in 1602. In 1603 he was called to a theological professorship at Leyden, which he held till his death in 1609.

Arminius is best known as the founder of the anti-Calvinistic school in Reformed theology, which created the Remonstrant Church in Holland (see REMON-

STRANTS), and contributed to form the Arminian tendency or party in England. He was a man of mild and liberal spirit, broadened by varied culture, constitutionally averse to narrow views and enforced uniformity.

ARMISTICE, a temporary suspension of hostilities by mutual agreement between two nations at war, or their respective forces. An armistice may be either general or particular: in the first case, there is a complete cessation of hostile operations in every part of the dominions of the belligerent powers; in the second, there is merely a temporary truce between two contending armies, or between a besieged fortress and the force besieging it. A general armistice cannot be concluded by the commander-in-chief unless special authority has been previously delegated to them by their respective governments; otherwise, any arrangement entered into by them requires subsequent ratification by the supreme powers of the states. A partial truce may be concluded by the officers of the respective powers, without any special authority from their governments, wherever, from the nature and extent of the commands they exercise, their duties could not be efficiently discharged without their possession of such a power.

ARMORICA. The Armorici were, in Cæsar's time, the Celtic inhabitants of the coast from the Loire to the Seine. The word appears to be composed of "*ar*," near, and "*mor*," the sea, and would originally be applicable to any maritime population.

ARMS AND ARMOR. The history of arms and armor forms one of the most suggestive chapters in the history of civilization. The use of stone weapons appears to have been universally characteristic of the earlier, as it is still distinctive of the ruder races of mankind. The forms of the weapons fabricated in this intractable material were of necessity few and simple. The commonest and most widely distributed type is that of the imperforate axe, varying from the roughly-dressed wedge of flint, to the finely-shaped and highly-polished lenticular "*celt*." They were fabricated of almost every material capable of being worked into the desired form, and of retaining the requisite sharpness of edge. Spearheads and arrow points were chipped in flint with such surprising dexterity and skill, that they were nearly as effective as those subsequently fabricated in metals, and not much inferior in form and finish. The highest efforts of the ancient stone-workers culminated in the short leaf-shaped knife-dagger of flint, suggestive of the form which afterwards became the characteristic weapon of the bronze age, the leaf-shaped sword. These knife-daggers of flint exhibit considerable variety of form, though always of the same type. They vary also in size, but seldom exceed about 12 inches in length. They are never ground or polished, but delicately chipped to a straight edge, while the flakes are so regularly removed from the convex portions of the blade as to give a rippled or wavy surface, and the corners of the handle are delicately crimped, thus producing an appearance of great beauty and finish.

The Bronze Age.—In the earliest interments in which the weapons deposited with the dead are of other materials than stone, a peculiar form of bronze dagger occurs. It consists of a well-finished, thin, knife-like blade, usually about 6 inches in length, broad at the hilt and tapering to the point, and always riveted to the handle by massive rivets of bronze. It has been found associated with stone celts, both of the roughly-chipped and the highly-polished kind, showing that these had not been entirely disused when bronze became available. A later type of bronze dagger is a broad, heavy, curved weapon, usually from 9 to 15 inches in length, with

massive rivets for attachment to an equally massive handle. The leaf-shaped sword, however, is the characteristic weapon of the Bronze Period. It is found all over Europe, from Lapland to the Mediterranean. The transition period between the Bronze and Iron Ages in Central Europe is well defined by the occurrence of iron swords, which are simple copies of the leaf-shaped weapon, with flat handle-plate previously fabricated in bronze. These have been found associated with articles assigned to the third or fourth century B. C.

The Greek Heroic Age.—The Greek sword of the heroic age is described by Homer as double-edged, long, sharp, and trenchant, the blade of bronze, and the hilt and scabbard adorned with gold or silver studs. In the Homeric combats, however, the spear, lance or javelin always plays the principal part, and the sword is only used when the combatants meet at close quarters, the spear having failed to decide the contest. Both sword and spear appear to have been of the forms which are characteristic of these weapons in the Bronze Age of Central and Northern Europe. The bow of Pandarus is described as made of ibex-horn and strung with sinews. The arrowhead is the only part of the warrior's equipment which Homer expressly describes as of iron, and the mode of its insertion in a split in the head of the shaft, where it was made fast by a ligature of sinew, is precisely that which is still adopted by modern savages with their arrow points of flint. The defensive armor of the heroic ages was also entirely of bronze. It consisted of helmet, cuirass, greaves, and shield.

Greek Historic Age.—In the early historic ages the characteristic weapons of the Greek armies were determined by the military tactics of the period. The mode of fighting in heavy phalanx necessitated the use of long, heavy spears. The Hoplites when massed in phalanx stood sixteen deep, the men of each rank close together, shield touching shield, the pikes of each line, 21 to 24 feet long, projecting from 2 to 13 feet in front of the foremost rank at equal distances. The shield of the early monuments, though still large, is not nearly so large as that of Hector, usually reaching from the shoulder to the knee, and still retaining its round or oval form and bold convexity. On the early vases the shields are represented as adorned with a great variety of devices.

Egyptian.—The strength of the Egyptian armies in the earliest times consisted of archers, who fought either on foot or from chariots. The Egyptian bow was somewhat shorter than the height of a man. The string was of hide, catgut, or cord. The arrows varied from 24 to 34 inches in length, and were usually of reed, winged with three feathers and pointed with heads of bronze. The spearmen fought in close phalanx, and were furnished with shields of a peculiar form, rectangular below and semicircular above, like a round-headed door, about half the height of a man. Their shields were covered with bull's hide, having the hair outwards, strengthened by rims and studs of metal, and furnished with a round sight-hole in the middle of the semicircular upper part. They had quilted helmets, and cuirasses of bronze scale or quilted with bands of metals, but no greaves.

Assyrian.—The Assyrian sword, as represented on the monuments, resembled the Egyptian, but was worn on the left side, slung in a nearly horizontal position by the waist belt. The bow was also a favorite weapon with the Assyrians, and lances, spears and javelins, with oblong, leaf-shaped and unbarbed heads, constantly appear upon the sculptures. The shield was round and convex; the helm frequently

conical, truncated or curved forward, and with pieces to protect the neck at the back and sides. Their cuirasses were close-fitting tunics made of many layers of flax, plaited or interwoven, and hardened and cemented with glue,—a species of linen corselet frequently referred to as in use also among the Egyptians, the Greeks and the Romans.

Etruscan.—The arms and armor of the Etruscans were in the main similar to those of the Greeks.

Roman.—The early Roman sword, like that of the Greeks, Egyptians and Etruscans, was of bronze. We have no direct statement as to its form, but in all probability it was of the leaf-shaped form so universally characteristic of this weapon in bronze. We gather from the monuments that, in the 1st century B. C., the Roman sword was short, worn on the right side, suspended from a shoulder belt, and reaching from the hollow of the back to the middle of the thigh, thus representing a length of from 22 inches to 2 feet. The blade was straight, double-edged, and obtusely pointed. On the Trajan column (114 A. D.) it is considerably longer, and under the Flavian emperors the long, single-edged *spatha* appears frequently along with the short sword. The characteristic weapon peculiar to Romans, however, was the *pilum*. The form of this weapon and the mode of using it have been minutely described by Polybius, but his description has been much misunderstood in consequence of the rarity of representations or remains of the *pilum*. It is shown on a monument at St. Remi, in Provence, assigned to the age of the first emperors, and in a bas-relief at Mayence, on the gravestone of Quintus Petilius Secundus, a soldier of the 15th legion. A specimen of the actual weapon is in the museum at Weisbaden. It is a pike with a stout iron head, carried on an iron rod, about 20 inches in length, which terminates in a socket for the intersection of the wooden shaft. When used as a javelin at short distances it had a most embarrassing effect.

Frankish.—The characteristic weapon of the Franks of the Merovingian epoch (450–760 A. D.) was the *francisca* or battle-axe, which they used as a missile. Procopius describes it as having a broad blade and a short haft, and it is said that the blow of an axe when hurled would pierce a shield or kill a man, and that the Franks rarely missed their aim. Agathias, the continuator of Procopius (535 A. D.), says they wear no body armor, few of them even having helmets, but they carry round shields, swords of the length of a man's thigh, axes having double edges, and darts which are used either for throwing or for thrusting. These darts had barbed iron heads, and were used as the *pilum* was used by the Romans. When the *angon* was fixed in the enemy's shield the custom of the Frank was to bound forward, place his foot on the end of the dart as it trailed along the ground, thus compelling the enemy to lower his shield, when he killed him with his axe or sword. The Frankish sword was a short, straight, broad-bladed, double-edged weapon, somewhat obtusely pointed, and usually about 30 to 32 inches in length. The sword and *francisca* of Childeric, one of the first of the Merovingian kings (457–481), were discovered in his tomb at Tournay in 1653, and are now in the museum of the Louvre.

Scandinavian.—The swords of the early Iron Age in Scandinavia are frequently found in the mosses of Schleswig, associated with objects bearing a strongly-marked analogy to those recovered from the graves of our own Pagan Anglo-Saxon ancestors, of the period dating approximately from the 5th to the 7th centuries of the Christian era. They are long, straight, double-edged, and often richly damascened. On the tangs of

several of those found at Nydam are the names of the armorers, some of which are of the Roman form. The grip of the hilt was circular, usually narrow in the middle, and the crosspieces above and below were similar in shape. The sheaths were of wooden laths, adorned with tastefully-executed mounting in bronze.

Anglo-Saxon.—The early Anglo-Saxon sword was usually about 3 feet long, straight, double-edged, broad in the blade, and rounded at the point, with hilt and grip and crosspiece like those of the early Scandinavian swords previously described. As the sword was not carried by any man under the rank ofthane, it is not often met with in Anglo-Saxon interments. With them, as with the Franks, it was a horseman's weapon, and the common accoutrement of the infantry was a spear, an axe, a shield, and *scurmasax*, or heavy single-edged knife. The Saxon spear was a narrow, long-bladed weapon, varying greatly in form and dimensions, but generally characterized by the socket being slit or unclosed throughout its length. The axe was narrow-bladed and single-edged, and sometimes peaked at the back. The shield which was circular or oval in form, was of wood, covered with leather, and furnished with a high conical boss, often terminating in a pipe or a button. Anglo-Saxon warriors of the 10th century are represented in the manuscripts as wearing hauberks of mail and rounded casques. The Ælfric manuscript, of the end of the 11th century, shows the trilobed sword hilt and round shield.

Norman.—The arms and armor of the Normans at the period of the conquest of Normandy were, of course, Scandinavian. The Norman arms of the period of the conquest of England are portrayed on the Bayeux tapestry. The sword is still of the Scandinavian type, long, straight, double-edged, and somewhat tapering, and round or obtusely pointed with crosspiece and pommel. The horsemen are armed with long lances as well as swords. On the tapestry the Normans are represented as well provided with archers and cavalry, of which the Saxons are apparently destitute. Maces and clubs appear also among the weapons; and axes, with shafts from 4 to 5 feet in length, appear in the hands of both Normans and Saxons. The Norman shield is large and kite-shaped, provided with arm-strap and handle, and adorned with emblazonments of badges or devices.

English after the Norman Conquest.—The armor in use in England since the period of the Norman Conquest may be briefly divided into four groups, each associated with its own historical period. True mail armor of interlinked rings was generally adopted in the time of the Crusades, and its use extended to about the beginning of the 14th century. Towards the close of the 12th century the long plaited or mailed skirt, divided at the bottom, as we see in the Bayeux tapestry, had been superseded by a short-sleeved tunic, generally of chain mail, reaching only to the knees, but sometimes covered with variously-shaped plates of metal. This short hauberk was confined by a belt about the waist, and furnished with a hood or coif, over which a close-fitting helm was worn. In the 13th century there was less uniformity of military equipment. The hauberk was again lengthened to the middle of the leg, and had a coif to cover the head, over which the massive helm with or without a nasal, was worn, sometimes with a movable visor. The sleeves of the hauberk were prolonged, and mittens added to protect the hands; the lower limbs were covered with mail, the coverings above the knee being called *chaussons*, and those below the knee *chaussés*. The sword was long, straight and pointed, generally

with a short recurved guard and rounded pommel. The shield was small, triangular, or heart-shaped; the helm massive, high, and flat-topped. After the middle of the 13th century secondary defenses of plate for the protection of the joints began to be introduced; the hauberk was shortened, the mittens of mail were divided into fingers, the helm was often rounded at the top, and greaves and shoulder plates were introduced. The period of mixed mail and plate armor extends from about 1300 to about 1410.

Artillery.—The adoption of gunpowder as an agent in warfare gradually revolutionized the whole system of military tactics, and was not only the ultimate cause of the total disuse of defensive armor, but rendered obsolete all the weapons of the Middle Ages.

Hand Firearms.—Hand cannon appear almost simultaneously with the larger *bombardes*. They were made by the Flemings in the early part of the 14th century, and before the end of the century considerable bodies of troops were in existence armed with portable *culverins*. At the battle of Morat (1479) the Swiss army is said to have been provided with 6,000 of these hand firearms. In England the yeomen of the guard were armed with them in 1485. At first these portable firearms were served by two men, but a smaller kind termed *petronels* were used by the cavalry. The long-barreled *harquebus*, the prototype of the modern firelock, having the touchhole on the right side of the barrel, with a pan for the priming, a trigger, and a pair of movable nippers, called *serpentine*, for holding the match, was invented in Spain in the time of Francis I. (1515–1547). The *muschite* (so named from the sparrow-hawk, like the *falcon* or small cannon) which was larger, heavier and more powerful than the *harquebus*, came into use shortly afterwards, and was well known in England before the close of the 16th century. On account of its weight it was provided with a long rest, forked in the upper part and furnished with a spike to stick in the ground. The *musket* and *harquebus* when first employed by the French armies were contemptuously spoken of by contemporary writers, by whom they were considered inferior to arblasts and crossbows. The wheel lock, which was invented at Nuremberg in 1515, was but sparingly applied to the *harquebus* and musket on account of the costliness of its mechanism and the uncertainty of its action. The same objection applied to the *snaphaunces*, the precursors of the first flintlocks, and even to the flintlocks themselves, which were invented in France about 1640, and it was not till the beginning of the 18th century that the flintlock musket finally superseded the old matchlock. In 1807 a Scottish clergyman, Alexander Forsyth, took out a patent for a percussion gun, though it was not till 1820 that it began to come into general use. The system of firing the charge by a fulminate was followed by the invention of the needle gun, the first model of which was constructed in 1827 by Jean Nicolas Dreyse, a native of Erfurt. Improvements in the mode of adapting the bullet to the rifled grooves successively led to the perfected system of the Minie rifle, by which the explosion of the charge expands the cup-shaped end of the conical bullet, and drives it into all the grooves, a process which was previously effected by hammering with the ramrod. The needle-gun was first made breech-loading in 1836, and since that time the improvements effected have been mainly directed to the combination of length of range with accuracy of aim and rapidity of fire. The most effective small weapons are probably the Winchester repeating rifle and the Colt revolving pistol, both American inventions. The

recent political agitations in Europe have caused great activity in the search for more effective engines of destruction, and it is claimed that in the event of war, European nations (France particularly) could send to the field armies equipped with weapons of almost marvelous power. The most radical change boasted of is a noiseless and smokeless powder of wonderful propulsive force. Neither breech-loaders nor revolvers are of modern date. Both were known in Germany by the close of the 15th century. There are in the Musée d'Artillerie at Paris wheel-lock *harquebuses* of the 16th century which are breech-loaders; and there is, in the Tower armory, a revolver with the old match-lock, the date of which is about 1550. A German *harquebus* of the 16th century, in the museum of Sigmaringen, is a revolver of seven barrels. Nor is a rifling a new thing in firearms, for there was a rifled variety of the old *harquebus* of the 15th century, in which the balls were driven home by a mallet, and a patent was taken out in England for rifling in 1635. All these systems were thus known at an early period in the history of firearms; but it is only the perfecting of their mechanism and rifling, the improvements in the gunpowder and the cartridge, and above all the adoption of the system of firing by a fulminate, that have enabled them to be used with the precision, length of range, and rapidity of fire, that now form such striking features in the warfare of modern times. It remains only to notice the bayonet, the invention of which, about 1650, has been claimed for Puseygue, a native of Bayonne. The bayonet, in its simple plug form, inserted into the mouth of the barrel, was adopted in France and England about 1675. In 1689 it was attached by two rings to the barrel by General Mackay, and the socketed bayonet was introduced by Vauban into the French army in 1703. In these days of precision of aim with long-range projectiles the bayonet, once the most decisive of modern weapons, has become of secondary importance.

The history of Arms in America discloses some remarkable features. Among these is the fact that a country isolated, defended by the seas, not given to military glory or under the necessity of maintaining extensive armaments, peaceful in all its ambitions and pursuits, should long since have become foremost in the invention and manufacture of improved firearms. This branch of the subject of Arms will presently be discussed; but meantime the arms in use in America before discovery or occupancy by Europeans has as a subject considerable interest. Savage arms never have included explosives of any kind, and their manufacture has for the most part been effected without the use of tools that civilization designates as such. The Mound-Builders, who came, lived, and passed away leaving no other record than mounds of earth, were an armed people whose elaborate stone weapons have been found by thousands. They mined copper and lead and used them in their native state, but they did not know how to smelt ores, and evidences of their having used anything but stone for their spears, knives and hatchets seem to be wanting. The shapes of these heads of flint are conventional, the same except in minor particulars, and made in the same manner as others found in other countries thousands of miles distant, and almost precisely similar to those in use by the North American Indian within modern times.

The principal weapon of these aborigines was the bow-and-arrows, and it had by them been brought to great perfection and efficiency. They had no tools, and wrought the bow and the arrow-shaft by a scraping process, the flint heads by skillful chipping, and

joined one to the other by insertion into a slit, or split, and by wrapping with sinew. The bow may perhaps be considered the one universal weapon, but also the probable first invention of the human mind. It has been found in use everywhere, and among peoples so far apart and so unlike that it is impossible that they could have borrowed it from each other. Beyond a certain efficiency it was never improved by savages, and even when so changed by civilized men it is doubtful if its efficiency was improved. The American Indian has never ceased to be proficient in its use. The descendants of those whom the colonists found on the Atlantic coast, the original Indians of the Western plains and mountains, and the scattered and decimated tribes of the southwest, are still partially armed with it, and prefer it for hunting. Its efficiency in their hands may be inferred from the fact that the writer has seen an arrow that had been shot through the huge body of a buffalo and was protruding several inches on the opposite side. It may be recalled that so acute and practical a man as Benjamin Franklin advocated the arming of the colonial soldiers with the bow, as being more efficient than the muskets then available and in use. In woods or swamps, noiseless and concealed, the Indian, both in Colonial and modern times, has repeatedly been more than a match for his foes bearing firearms. The bow was the means for the preservation of the independence, often of the very existence, of every people, including, within historic times, our own English and German ancestors.

Relying upon historical accounts and frequent mention, we must infer that the weapon next in importance to the bow among the aborigines was the hatchet; or, as ordinarily spoken of, the tomahawk. Before they understood the forging of iron, or a cheap variety of the tomahawk 'had been made by white men as an article of barter, this weapon was of stone invariably. There can be no more pitiable view of abject barbarism afforded than that suggested by this instrument wherever found. It is impossible that it should ever have cut, as we must understand that word. It could only bruise or mangle. It never had an eye, or perforation for the insertion of the handle. With infinite pains and toil a groove was worn around its middle, and a green withe was wrapped and twisted there to serve as a handle. To be fairly proportioned, and to be slightly thinner at the cutting end than at the blunt, was the savage idea of what to civilization is an axe. Sometimes, as an improvement not often available to an interior tribe, it was a flat shell, notched so as to be more easily and securely tied with sinews to a stick.

But the arm in universal use was the club. This was the simple and natural weapon any one might avail himself of with little pains, and used even by some of the apes. Yet in the hands of men it lost much of its primitive character. The knightly mace of the middle ages was but a maul, an iron club. The Indian weapon, first formed of goodly size and natural proportions, was afterwards shaped and ornamented until it became to its owner a thing of pride, an ornament, something of what an officer's dressword may be to him.

It must be remembered in any discussion of weapons of the Indian that battle, in the sense in which we understand the term, was unknown to him. He never opposed force to force in an open field. His tactics consisted in creeping, in being there only when not suspected, in taking unawares, and then in killing all. The light bow served him admirably in hunting and in running warfare behind trees and brakes, but it

would be almost useless among sleeping enemies in camp or hut. So the shield, if used at all, was chiefly an ornament not intended ordinarily for actual fending of blows.

There was one other weapon, or tool, absolutely indispensable in Indian warfare, in all times and among all tribes, and that is the one most difficult to account for when we consider its use, which was to remove and enable him to carry away as a trophy his enemy's scalp. When accounts more or less authentic were first written of the aborigine and his life and ways, he was already provided with a knife made by white men. So he has ever since been. Probably the knife, the tool that would actually cut, was his first and most valued acquisition. His only cutting tool previous to this must have been merely one of the ragged-edged flint knives so often found in his ancient haunts.

The arms of the discoverers and colonists were those of their times which they brought with them, yet many readers of the chronicles of those times have little idea of the comparative crudity of the first firearms used in America. The first discoverers, indeed, the Northmen, had no firearms at all, and in this connection reference can only be had to our own forerunners and ancestors. The first Indian wars in America were unquestionably waged by the whites with matchlocks, and lacking even these with pikes. Armor was still used also, and, until the Indians obtained firearms, was considered a protection not to be abandoned. Fighting alert and active savages, armed with bows, with guns that were so heavy that they must be rested in a forked stick to fire them, and that could not be fired at all after the match went out until more fire could be procured, or stirring the same active enemies out of ambush with a long-handled pike, must seem to the modern reader a quaint picture of the weapons used in warfare actually waged on American soil within historic times.

Though the history of the United States has been an almost unbroken peace as compared to the lives of other nations during the same period, arms have been the natural possession of all our citizens, the right to their ownership and use being one of the provisions of the organic law. An interesting subject would be the arms of the people during the period intervening between the earlier settlements of the Atlantic coast—the times referred to when the arquebuse, musketoon and pike were still considered weapons—and the intervening time when the entire Mississippi valley was occupied by pioneer white men who subsisted by arms, and who lived, ate and slept with their arms beside them. The arm of this period is traditionally the rifle, sometimes called the "Kentucky Rifle," generally the "American" rifle. Daniel Boone and his successors, the settlers of Tennessee, Indiana and Illinois, the pioneers of Michigan, all the actors in that romantic period of American history whose stories have been written thousands of times and yet have never been told, were supposed to have been armed with this celebrated weapon, the most effective in its final results, and therefore the most entitled to a historic place, that ever was placed in the hands of man.

Perhaps it would now be quite impossible to find a specimen of this gun with a flint lock, though it was unquestionably so made until about 1840. The rifle of Daniel Boone was such, and probably was not a rifle at all, but smooth in the bore; rifling, a step marking decided and permanent progress in the manufacture of arms, being then an experiment lacking the means of accurate accomplishment. Rifles of a

still later period are now rare, though many living men can remember them and have even used them. The gun was long, often four-and-one-half feet in the barrel, and was of such bore as to take a cast bullet weighing a hundred and twenty-five to two hundred to the pound of lead. The bore of many of those rifles was, indeed, not larger than what we now call "thirty-two calibre." Lead was heavy and difficult of transportation, and powder was hard to get and liable to damage. The "stock" of the piece extended as a thin, triangle-shaped piece of wood, almost to the end of the barrel, and a slender hickory ramrod lay in a groove on the under side of this, held in place by the "thimbles" of sheet brass. It was customary to have this ramrod extend when in place some three inches beyond the end of the barrel. The "breach" as the extension which was held against the shoulder was called, was thin and long, shod with brass, with the "heel," as that part is now known in describing military arms, prolonged into a spur which held well in the ground when ramming the bullet. This was necessary because the gun was so long that it was loaded at a considerable slant. So the contrary of being rude, crude, rough, or inaccurate, the American rifle was one of the handsomest firearms ever constructed. It had its uses often far from repairs or skilled mechanics, and it must be and remain reliable and accurate in all its details.

And in connection with the making of this celebrated arm there are facts, seldom or never mentioned, which have a bearing upon the wonderful mechanical progress of this country. The science of the manufactory was then unknown. The theory of *interchangeable parts*, upon which the entire edifice of modern manufacturing progress rests, and which had its first trial with firearms and its first success in this country, was then undreamed. There were men in those crude days, village mechanics, working without lathes, tools of accuracy or power, who could make and assemble every part of this gun, "lock, stock and barrel." It was proved, elaborately ornamented, varnished, burnished, sighted and sold, at a cost of about twenty dollars. To cut the rifles of muskets when rifling came to be adopted, required long and patient experiment with machinery, yet these frontier gunsmiths did it accurately by hand, making their own tools, and no one seems to know where, from whom, or how they learned.

The loading of this arm was an elaborate operation. The bullet was a cast one invariably, the "moulds" being an indispensable accompaniment of the gun and was always pushed home in the barrel lined with what was called "patching." A piece of buckskin or cotton cloth was laid over the muzzle, the bullet was laid upon this and pressed into the bore. The "patching" was then cut away above the bullet with a knife, the ramrod drawn and inserted, and bullet and lining were pressed home to the powder with both hands, and considerable force. Once home the ramrod was taken between the thumb and finger and flung down upon the bullet until the rebound carried it several inches up the barrel. Until this was done accurate shooting was not expected, and it may be readily seen that the operation required several minutes, considerable labor, and that the marksman was not likely to fire at random afterwards. All this would seem to preclude the possibility of effective use of this arm in military operations. The precise opposite was true. As an instance the battle of New Orleans was fought and won, with enormous loss to a trained and veteran enemy by such men, with such guns, loaded as stated, but fired with the deliberate accuracy of habit.

The men who owned and used these guns lived by them. They were compelled not to waste their bullets. The stories of their accuracy are precisely like those that have come down to us from the English long-bowmen. One shot must kill. Many of the hunters and pioneers of those times would never kill game otherwise than by shooting the given animal in a given vital spot. In the case of small game, as squirrels, pigeons, quail, pheasants, the least expected was that the head must be shot off. When the "shot-gun" came in it was regarded as disgraceful, and its owner was looked upon with contempt. So expert were these men with their chosen weapon that numbers of them were known never to miss, and the largest game of the forest was certain of defeat if only one little bullet were left. The story of the American rifle has been dwelt upon because it is so greatly a factor in American history. By it a continent was won, and the deadliest antagonists the world has ever known, in the woods and mountains, behind cotton-bales at New Orleans, or at Tippecanoe, were the men who carried the long weapon across the shoulder wherever they went, who rammed home the bullet and "patchin'" with pious care, and who held their fire until they were sure to kill.

When the percussion cap came to be used it was almost instantly adopted for this rifle, and with it came that strictly American invention known as the "double-trigger," or "hair-trigger." The origin of this ingenious device is lost, but it was most likely the practical contrivance of some gunsmith, to prevent the "pull" of the ordinary trigger from deranging the aim in offhand shooting. In this arrangement there was a curved trigger immediately behind the firing-trigger, which was straight. This curved trigger was pulled back first, the piece with which it was connected on the inside of the lock-plate catching in a notch. The gun was then cocked as usual. The details would be difficult to describe without drawings, though its operation was simple. It relieved the firing-trigger from the direct pressure of the mainspring, and made an indirect, though instantaneous, release of the cock in firing. The term "hair-trigger" arose from the fact that rifles were very commonly made whose discharge could readily be effected by the pull of a single hair upon the firing-trigger. The "hair-trigger" dueling pistols of times a little later were long-barreled rifled weapons whose locks were arranged as above described. A strange revolution in the ideas of the users of firearms is shown when we reflect that the "pull" now required in military and sporting weapons is from eight to twelve pounds, and that the aim is made with the pull of the finger gradually increasing up to the moment of firing.

The story of arms in the United States has always been the story of practical adaption or invention, for the most part unrecorded and not patented, and now relegated to oblivion. But now for many years such establishments as the Colt's company of Hartford, the Sharps of the same place, the Winchester company of New Haven, the Providence Tool Company of Providence, and the Remington Arms Company of Ilion, have been making arms almost literally for all the world. The United States arsenals situated at various points, have not been dilatory either in adopting inventions or in improved manufactures, but the establishments named above, with others, represent the epoch of *applied invention*, and this inventive epoch will now be noticed. As previously noted, the nation least engaged in actual warfare has led all others. Without attempting to account for this fact, the story is both illustrative and interesting.

The key to the success of practical invention is the ability to make *absolutely interchangeable parts*. An innumerable multitude of machines are now so made. All that are successful have this principle as a basis, but the problem was first solved in the department of arms. In the year 1722 it was proposed in France to make the lock of the *fusil*, the first flint-firing musket, *identical and interchangeable*. Ten years later, in 1732, the idea had not succeeded, and was definitely abandoned. Again in 1785, more than fifty years after the first attempt, the experiment was again tried, and after a second ten years was again abandoned as an absolute failure. A commission reported upon it, and their report, supplemented by that of experts and writers, relegated the subject to final oblivion. It was thenceforward experimented with no more.

But in 1813 an American named Hall proposed a *breech-loading* musket, whose parts should be "interchangeable and identical." In 1817 Hall had finished some of his breech-loading guns, and a government commission was appointed to try them, and found them, in respect to the interchange of the parts, so satisfactory that Hall was employed to effect the introduction of the system at the United States Army at Harper's Ferry. The question which in the opinion of the commission had been solved was truly so, and since that date all arms in the United States, of whatever pattern, have been so made, as they were later, and are now, all over the world.

In 1816 a man named Blanchard, at the United States Arsenal at Springfield, turned the exterior of gun-barrels, *flats and all*, on a lathe. Flats had hitherto been filed *after* the round parts had been turned. This was afterwards, and now is, done everywhere.

In 1817 a man named Shaw, of Bordentown, proposed the use of percussion *caps*, to fit that part of a gun that is called the "nipple." There was for some years a dispute as to the priority of this great invention, but since the percussion cap was unknown in England or in France until about 1820, and fulminate of mercury was not proposed in England until 1819, Shaw's claim was considered to be original, and the Congress of the United States gave him an honorary award. That was before the day when business shrewdness kept pace with the inventive faculty. The government took the invention, adopted it, used it, and thanked Mr. Shaw publicly by act of Congress.

In the year 1820, Blanchard, at the Arsenal at Springfield, Mass., finished the first gunstock lathe. At the United States exhibit at Philadelphia in 1876 thousands of visitors were astonished at the deftness of the miracle of automatically turning out a musket stock in such a way as to complete the process within a few minutes, leaving nothing to be done by hand. This was Blanchard's idea, and the legacy he left to posterity.

In 1827 occurred at Harper's Ferry Arsenal the crucial test of the *interchangeable part* idea of Hall. He had made a hundred muskets. The parts of these and the parts of one hundred muskets made in the old way were separately mixed. Experts then took these parts indifferently as they came, and assembled the two hundred guns with them. They all fitted, though the handmade parts were put to the stocks made for Hall's pieces, and Hall's were fitted to the stocks made for the handmade locks.

But a still more crucial test was soon to be made with this great system of interchangeableness. In 1847-48 occurred the war with Mexico. The system was in vogue, the making of arms had been conducted accordingly, and the scheme that had always failed before must be tried, and risked, in the field. The result was that all the arms in use in that war were

kept serviceable with pieces carried in the ordnance supplies, and that had never been assembled before. Yet the American reader is amused and surprised at the general jumble of arms exhibited by us in actual use in that period of transition between flint and percussion, old pieces and new, the decay of the past and the beginning of the present. There were for the infantry both flintlocks and percussion, all smooth bore. For the cavalry a carbine, percussion, and of a bore of 0.52 inch. The artillery had the last of the muskets, altered to percussion, and of a bore of 0.69 inch, and there was a general armament of pistols, all smooth-bore, a mixture of flint and percussion, and all having a bore of 0.54 inch. It is impossible to conceive of the absurdity of the arms even of those very recent times, without placing side by side a smoothbore, single-barrel, flintlock pistol, of a calibre of more than half-an-inch, beside a modern Smith and Wesson revolver.

Notwithstanding all improvements since made, there is little question that the single triumph of successfully making *precisely similar and interchangeable* parts is one of the greatest in American mechanics.

Success in the manufacture not alone of arms, but of all other duplicated machines, of any kind whatsoever, depends upon it, and from it grew all modern manufactures. It was not a discovery. It had been repeatedly and patiently tried, and at last it came as the result of patient endeavor with a knowledge of the means necessary. The machinery necessary was an invention, or a series of inventions, and in 1853 the English bought in the United States the machinery necessary to carry the system into effect in the manufacture of their own arms at Enfield.

From this date it is useless to continue in detail an account of the improvements in the style and manufacture, and machines for the manufacture, of American arms. The great step in actual invention was the making practical of an idea almost as old as gunpowder: the revolving multiple chambers of an arm, all to be discharged in turn through a single stationary barrel. This was accomplished by Col. Samuel Colt, whose idea was patented to him in 1835, but whose revolutionary weapon was not actually made until about 1848, and was not sold and in actual use until about five years later. The invention of Col. Colt is the mother of all the rest. He was little aided, if at all, by ancient models and former attempts, since it was necessary not alone to revolve the barrel, but to make the entire action of the arm automatic and sure, beyond liability to derangement or uncertain action. Colt's original revolver, almost without alteration of the essential parts, is the exclusive personal weapon of mankind today.

The next American arm in point of efficiency and celebrity after the revolver is the Gatling gun. This was invented by Mr. Gatling in 1861-62, but it was not brought forward during the great struggle following those years, on account of the time required in perfecting its mechanism, and in raising the capital necessary for its construction. This now celebrated arm is simple in construction, light, adapted to the ammunition in use with other arms, and made of several sizes. In reality it differs from the revolver in the details of its mechanism, and in revolving barrels of full length instead of short chambers discharged through a single main tube. It also loads and discharges its empty shells automatically, and is entirely operated by the turning of a crank. Its common size, using the ammunition of the Army rifle, has an effective range of about 800 yards, and it requires little imagination to depict the destructiveness

of such a machine, firing, when required, 400 shots per minute.

We have now given at some length the original processes and principal steps in the line of improvement and invention in arms in the United States. The reader will observe that once these preliminary difficulties were overcome, that which has followed in more recent improvements was natural to a people whose genius seems to have specially led them in this direction. It will be noted how the solving of the problem, of pieces all alike, and fitting infallibly with other pieces without handwork or tools, made it possible that Colt should supply mankind with revolving pistols, and how without this prior success his mere invention—and nearly all others of modern times—would have been of no practical utility. The gradual evolution of fixed metallic ammunition out of the paper cartridge, first used in European armies, made possible the magazine rifles of today, which have entirely superseded all others. In all these, and up to the date of this writing American ingenuity has in most cases been the originator, and in all has been the practical improver, adapter and manufacturer.

It will also be inferred, and with correctness, that in the United States an *unsupported idea* in arms has been of little or no value. Men have dreamed and schemed ever since men could consecutively think. The very first field-guns were breech-loaders in intention. The Spaniards brought them to these shores at the time of the conquest by Cortez. Revolvers are shown in museums that were made not later than the fifteenth century. Breech-loading small arms were contrived and probably used until found useless not later than the year 1700. A rifled carbine was proposed in 1630. The cartridge of paper, in which both ball and powder were inclosed in one cylinder, was introduced by Gustavus Adolphus in 1610. In nearly all these things the practical utility remained in abeyance until a time within the memory of men not old, and almost every one, knowingly or otherwise as to priority of original idea, was first made practical in this country.

ARMSTRONG, JOHN, a physician, litterateur, and poet, the friend of Thomson, Mallet, and Wilkes, was born about 1709 at Castletown, Roxburghshire, where his father was parish minister. He graduated M. D. at Edinburgh university, and soon afterwards settled in London, where, however, his professional success was small. In all probability he paid more attention to literature than to medicine. He died in 1779.

ARMY, "a collection of armed men obliged to obey one man" (Johnson); "a collection of troops of all arms formed into brigades and divisions, placed under the orders of one commander, with a general and special staff and administrative departments; provided with all necessary war material, and destined to act offensively and defensively against the enemy." Neither definition is quite satisfactory. The first is too comprehensive; the second excludes the forces of all but highly-civilized nations. The essential characteristics of an *army*, by which it is distinguished from other assemblages of armed men, are its *national* character—that is, its representing more or less the will and the power of a nation or its rulers—and its *organization*. The degree of the latter must depend on the age and the state of civilization; the armies of former days we should now call mobs. The art of war has kept pace with the arts of peace, and there is as much difference between the armies of the present and of the past as between an elaborate modern machine and an early stone implement. But armies of some kind have existed since the earliest periods of man's

history. At no time has industrial accumulation, with its results, progress and civilization, been possible unless accompanied by the will and power to defend it. No nation has made its mark in history that has not at some period of its existence been preëminently distinguished for martial spirit and proficiency in arms; or been allowed to throw its full energies into the pursuits of peace till it had proved what it was able and willing to do and endure in war.

The art of war divides itself into two distinct branches—the first relating to the military institutions of nations, the manner in which armies are raised, their composition, characteristics, organization, and government; the second to their employment in war.

The first, commonly known as the administration or organization of armies, is that of which this article treats. A modern army is a vast and complicated machine, so constructed that the whole aggregate force of its numerous parts may be exerted in any direction and on any point required. It is our province to describe this machine in a state of rest, explaining the construction, purpose, and combination of its several parts, but leaving its action to be treated of elsewhere (see WAR, page 6253 *et seq.*).

In the earliest stage of civilization the army is identical with the tribe or nation. Every man is a warrior; even women and children accompany the expeditions, prepare and carry food, and bear such share as they are fitted for. In more settled communities the able-bodied men only take the field, while women, the children, and the aged remain at home to watch the herds and till the fields. Production is still so small that no division of duties among the men is necessary. The armies consist of the whole male population, collected under their chiefs and heads of families, or under warriors who have specially distinguished themselves. Such were the earliest armies mentioned in history, and such are still the armies of the savage nations with whom the progress of civilization brings us in contact—well fitted for petty warfare between neighboring tribes or nations, when the assailants confine themselves to raids for plunder and captives, but not for distant expeditions or prolonged operations. As population and industry increase, a division of labor becomes both possible and necessary. A select portion of the inhabitants are specially devoted to military service, either permanently or for a time, while the remainder give undivided attention to pacific pursuits. Standing armies and permanent organization are thus introduced, and lead to improvements in administration and progress in the art of war, till finally we attain to the perfection of modern organization.

History points to Egypt as the first country in which a regular military organization was established, and the warrior class, as such, distinguished from the rest of the population. By its earliest laws the revenues of the state were divided into three equal parts, of which one went to the priests, one to the king, and one to the warriors. Sesostris seems to have been the great military organizer of Egypt. Trained by his father from childhood to war, he early distinguished himself in military expeditions against the Arabians and against Lybia, and mounted the throne with visions of universal conquest. To pave the way for such schemes, he gave Egypt a military organization, dividing it into thirty-six provinces, and establishing a militia or warrior class, called *Kalasires* and *Harmatopoi*, to each of whom was allotted land sufficient for the maintenance of himself and his family. These formed the nucleus of the vast army, amounting, according to Diodorus Siculus, to 600,000 in-

fantry, 24,000 cavalry, and 27,000 war chariots, with which he undertook the conquest of the world. We read that the command of this army was given to the companions of the king, who, like himself, had been trained to arms under his father, and that a strict discipline was maintained and a military code established which forbade corporal punishment, appealing to the higher instincts of the soldier; but of the details of organization and administration by which so vast an army was moved and fed we can learn little. With this army, aided by a powerful fleet, Sesostris first subdued Ethiopia, and then extended his conquests eastward as far as the Ganges; thence turning northwards and westwards, he swept over the Punjab, the table-land of Tartary, and the north shores of the Caspian, and descended through Sarmatia and Dacia into Thrace. Finally, he overran Asia Minor, and having conquered the Assyrian empire and seated himself on the throne of Ninus and Semiramis, returned in triumph to Egypt after a nine years' absence, and devoted the rest of his life to the peace and prosperity of his kingdom. Such are the accounts handed down by the ancient historians; and if any faith is to be attached to them, it seems clear that he did actually raise and maintain large armies, and with them carry out prolonged and distant expeditions, extending over several years, without interrupting the industry and progress of his own country—facts which on themselves prove a high degree of national and military organization.

The martial spirit of Egypt, however, seems to have expired with its first and greatest conqueror, and as a nation it has distinguished itself in the arts of peace rather than those of war. The country became the prey of the conquerors and the battlefield of other nations, and the palm of military supremacy passed successively into the hands of the Assyrians, the Babylonians, the Medes, and the Persians. The first two nations present no special features in their military systems; their armies like those of Egypt, consisted mainly of infantry, horsemen and chariots forming but a small though highly prized element. But the Persian empire introduces us to a more highly developed military organization, and a system of standing armies closely resembling those of modern times. Drawn from a hardy and nomadic race, its armies at first consisted mainly of cavalry, and owed much of their success to the consequent ease and rapidity of their movements. Constantly extending their power by fresh conquests, the warlike Persians established themselves as garrisons in the subjected provinces, gladly exchanging their own barren mountain lands for these rich and fertile countries, and for some time remained a distinctly conquering and military race. Their empire attained its highest power under Cyrus and Cambyzes; the former, the founder of the great Persian empire, uniting on his head the crowns of Babylon, Media, and Persia, while the latter still further extended the empire by the conquest of Egypt. Cyrus seems to have been the founder of that complete military organization of which we gather details from Xenophon and other writers. To each province of the empire was allotted a certain number of soldiers as garrison or standing army. These troops, formed originally of native Persians only, were called the king's troops. They comprised two classes; the one devoted exclusively to garrisoning the fortified towns and castles, the other distributed throughout the country. To each province was appointed a military commander, responsible for the number and efficiency of the troops in his district; while the satrap, a civil governor, was answerable for their subsistence and

pay. Annual musters of these troops were held either by the king in person or by generals deputed for the purpose, and invested with full powers. This organization seems to have fully answered its original purpose, that of holding a vast empire acquired by conquest, and promptly repelling inroads or putting down insurrections. But when a great foreign war was contemplated, the standing army was augmented by a levy throughout the empire, and each province and tributary nation furnished its quota of men, horses, and provisions. The extent of the empire made such a levy a matter of time. Thus the preparations for the invasion of Greece by Xerxes took three whole years; and the heterogeneous and unorganized mass of men of all nations so brought together was a source of weakness rather than strength. That the warlike Persians, whose reputation rose so high under Cyrus, who were distinguished for their powers of endurance, and a daring courage which despised stratagem and delighted in single combats, should within a century have failed so disgracefully against the Greeks, has often been matter of wonder. Something, doubtless, was due to the fact that their reputation was won over effeminate races very different from their later antagonists; something also to the degeneracy induced among themselves by years of success and luxury. But it must also be borne in mind that the vast hosts over which the Greeks gained such easy victories comprised but a very small proportion of the true Persians—of the race which had given Cyrus his conquests.

The earliest knowledge we have of the military institutions of the Greeks is derived from the pages of Homer. They are glimpses only that we obtain, but they suffice to distinguish many of their characteristics. Their compact formations and subordination and silence in the ranks are contrasted with the looser formation and noisy attacks of the Trojans. Their armies consisted almost entirely of infantry. The leaders fought either on foot, like the rest, or from chariots; and single combats between the chiefs of the two sides were common, and often served to open the battle.

By the laws of Athens every free man was liable to military service. It was not only his duty but his distinction and privilege. The slave worked, the free-man devoted his time to military exercises and the gymnasium. The only privilege granted to the wealthy was that of serving in the cavalry. The infantry, of which the army was mainly composed, consisted of three classes. First were the heavy troops, "hoplitai," armed with a spear, a dagger, a corslet, and a large oval shield. These formed the phalanx or main line of battle, and were composed entirely of free citizens, natives of Attica. Secondly, the light troops, "psiloi," armed with javelins, but carrying little defensive armor, and no shields. These were destined for skirmishing and covering the movements of the phalanx, and were mostly slaves, who followed their masters, serving among the "hoplitai," to war. Thirdly, there were "gumnetai," or irregular light troops, carrying no defensive armor, but provided with javelins, bows and arrows, and slings, to harass the enemy; these usually consisted of slaves or foreign troops. Besides these there was another class, "pelastai," so called from the light shield or target (*pelta*) which they carried, and intermediate between the "hoplitai" and "psiloi." The cavalry consisted entirely of the wealthier Athenians, and was intelligent and enterprising.

The Spartans owed much of their specially soldierly qualities to the institutes of Lycurgus, which had for their aim to form a nation of warriors, and develop to

the utmost those physical and moral qualities which render men invincible. Discipline, unquestioning obedience, uncomplaining endurance, and contempt of danger, were the principles inculcated on the young Spartan from his earliest years, while his body was strengthened by every exercise and trained to every fatigue. As with the Athenians, military service was the first duty of every citizen of Sparta. The age of enrollment was twenty instead of eighteen; but the service lasted till sixty, and was more severe. Cavalry was held in disrepute in Sparta; their infantry was formed in five "moras," or regiments, corresponding to the five tribes; later, a sixth, which included a small force of cavalry, was added.

Macedon, inhabited by rude but hardy shepherds and hunters, and far behind its southern neighbors in civilization, had made no mark in history till Philip ascended its throne. But this monarch, who combined the highest military qualities with a far-seeing shrewdness which was fettered by no strict principles of honor, had no sooner established himself than he devoted all his energies to raising the military power of his country and extending his authority. He set himself to form a standing army, to which he gave an organization, copied, but improved, from that of his adversaries. By force of arms, by treachery, or by policy, he increased his power and influence until it embraced all Greece; and he was about to make war on Persia at the head of her united armies when his death put an end to his ambitious projects. But his son Alexander had all his father's military genius and ambition, and at the same time inherited the instrument he required in the highly-trained army so carefully prepared. Within a year he had chastised the Thracians in the north, stamped out the Greek revolt by the storming and destruction of Thebes, and received at Corinth from the representatives of the southern states the chief command over their united forces; and in the following year crossed the Hellespont at the head of an army of 35,000 men, and commenced that career of conquest which was not to cease till he had carried his victorious arms over India, and founded the largest empire the world had yet known. The army with which these astonishing campaigns were won was composed of native-born Macedonians, of their allies, and mercenaries. None but native Greeks were admitted into the phalanx or cavalry. The cavalry, which was more numerous than that of the Spartans or Athenians, was also divided into heavy and light; the former carrying horse armor as well as body armor. The principal weapon was the *sarissa* or pike, 24 feet long, of which 18 feet extended beyond the grasp. Thus the pike heads of six ranks projected beyond the front, and formed that bristling mass of spears which gave the phalanx its formidable appearance.

The early or legendary period of Roman history is enveloped in a darkness which hides the rise and first development of those institutions which ultimately gave to Rome the empire of the world. Her earliest military organization is attributed to Romulus, who grouped the great families or clans ("gentes") in three tribes; each required to furnish 1,000 foot soldiers and 100 cavalry, and in the force so raised is traced the origin of the Roman legion. Originally Roman citizens only, belonging to the five upper classes, were admitted in the army, and the soldier equipped himself at his own cost, and received no pay. Afterwards, the *socii* or allies were included in her armies, and in the time of Polybius a consular army consisted usually of two legions, or 9,000 Roman soldiers and about the same number of allies or *socii*.

But under the pressure of the great Punic wars the consular armies were often doubled; at Cannæ two double consular armies, or nearly 80,000 men, were brought together; and at one period of the second Punic war as many as 23 legions were raised. The system of payment, too, dating from the prolonged siege of Veii, removed the reasons for exempting the poor from military service, and they were included in the levies, though usually detailed to the navy as an inferior service. Finally, when civil wars had shaken the old institutions, and everything was sacrificed to faction and party spirit, even slaves and criminals were enrolled, and the whole character of the army was changed. Other causes also tended to the same result. The system of raising the consular armies annually, and disbanding them at the conclusion of each campaign, required to be modified when distant wars were undertaken; legions were kept permanently under arms, and recruited annually by levies sent from Rome; ambitious generals found excuses for not disbanding the armies to which they owed their power, and by degrees a standing army was established; and these changes in the character of the army were accompanied by corresponding changes in its organization and tactics. The distinction between the three ranks became gradually effaced, and the three corresponding manipuli were merged in the *cohort*. The manner of fighting, too, was gradually changed, and the Roman soldier learned to trust less to his sword and heavy *pilum*, only useful at close quarters, and more to javelins and warlike instruments.

The turning point in Roman military art is commonly fixed about the time of Marius, to whom the change in the organization, as well as the composition, of the Roman armies is attributed. But the evil effects did not make themselves felt immediately, and the legions, whose actions under Cæsar shed the brightest luster on the Roman arms, were organized on the new system. So long as discipline and the old military spirit remained, the Roman armies retained their superiority, whatever their tactics. This spirit was too deeply implanted to die out soon; and whenever men arose worthy to command them, the Roman soldiery regained its reputation. But under a succession of weak and profligate emperors all discipline was lost, the legions, degenerated into a feeble militia, sold the empire which they were incapable of defending, and ultimately fell an easy prey to the rude and daring barbarians of the North.

Hitherto war had been a progressive art. Each great military power succumbed in its turn to an organization and a science superior to its own. But with the fall of Rome we seem to begin afresh. The nations, by whom the overthrow of this great empire was effected, were in the condition from which the Latins had emerged ten centuries before; and more than ten centuries elapsed before the lost ground was regained, and such highly-trained armies again appeared.

The early institutions of the Frank and German races, the new masters of Europe, were those of a free, proud, warlike people. The right to bear arms was the privilege of the freeman, the mark of his status in the community. No man could assume it till publicly pronounced worthy, and solemnly invested before the assembly of the people. From that time he was never separated from his arms. The same word (*wehr*) denoted a weapon and a freeman; even his plot of land (*were*) was named after that by which alone he held it, and his social existence ceased when no longer able to carry arms or mount his horse. Similarly, nation and army were convertible terms; the Longobards

continued to call themselves an army (*Herr*) long after their settlement in Italy. Their organization was rude and simple. The family was the basis of the social fabric; kindred families formed clans, and these again confederations (*Markgenossenschaft*), to which admission was only obtained by common consent. Finally, the kindred tribes or communities occupying a certain district (*gau*) formed a higher organization (*gauemeinde*), which usually included the whole of a particular race or stock, and had well-defined natural boundaries. For political and military purposes the *gau* or province was subdivided into "circles" (*Kreis*) and "hundreds," names which have continued to this day; the latter calculated to include as many households as would suffice to place a hundred warriors in the field. Kings and commanders were elected and were intrusted with absolute power in war time, but in peace every freeman claimed perfect liberty; all great questions were determined by the people in public assembly, and all conquests were the property of the community, to be shared equally among them. It is hard to imagine a greater contrast than that between the perfect freedom and equality of the early German institutions, and the tyranny and unequal rights of the feudal system which succeeded it. But we can trace the gradual transition. From early days the most adventurous youths attached themselves to the hero of the nation or tribe, to be instructed by him in peace and led to victory in war. Thus each great warrior collected round him a band of personal followers—retainers, whom he equipped with horses and armor, and rewarded with a share of the booty, and who in return followed him in all expeditions, and obeyed no law but his word. When conquests were effected by such bands, the land was the property of the chief, and was distributed by him as a reward to his followers. Gradually kings and chieftains increased their retinues, extending protection to those who obeyed them, and enriching them by grants of land acquired by conquest and seizure. These grants soon ceased to be free gifts, rewards for past service, but were held to entail future service also; and the chiefs assumed the right to revoke them. As the power of the nobles and the number of their retainers increased, so did the number and power of the independent freemen decrease; a prey to oppression and exactions of all sorts, they attached themselves in self-defense to some neighboring lord, surrendering their lands, and consenting to hold them of him as vassals. Finally, the lords increased their pretensions, assuming the titles of "suzerains" or "seigneurs," claiming absolute authority over the person and property of their vassals, and requiring an oath of fealty from them; and the feudal system, with all its grinding tyranny, was established. Nations were broken up into small seignioralties, whose lords, at constant war with each other, only united to resist any interference with their privileges; and if occasionally a powerful ruler like Charlemagne succeeded for a time in establishing a real government, it was only personal, and collapsed as soon as the strong hand was removed. No great national undertakings, no great progress in the arts of peace or war, were possible under such conditions; and it was not till feudalism was nearly extinct that these arts emerged from the darkness of the Middle Ages.

The early Frank and German armies comprised the whole manhood of the nations, rudely organized by "hundreds," or by tribes and families. Some knowledge of tactics had been gained from their adversaries, the Romans, and from deserters and escaped slaves in their ranks; but they usually adhered to their own

national formation, the wedge-shaped column of attack. The principal arm was infantry, divided into "heavy" and "light," the light infantry being originally the *élite*, and trained to act with the cavalry, but afterwards degenerating into mere attendants of the latter. The transition from the national to the feudal system is seen in the armies of Charles Martel. These consisted in part of his personal followers, partly of mercenaries, and partly of national levies. At Tours the latter still formed the great bulk of the force, and fought, as of old, in heavy masses and with little tactical organization. Under Charlemagne armies became more feudal, the chiefs and their retainers forming a large proportion, the national levies a much smaller one; and the frequent levies ordered in his reign did much to extinguish the class of freemen, driving them to seek protection as vassals of the great nobles. The true feudal armies were formed entirely of the knights, men-at-arms, and vassals who obeyed the summons of their suzerain, either at the call of the king, or for his own private wars, and whose service lasted variously for twenty or forty days or three months, at the end of which the army disbanded and returned home.

The change in the constitution of armies was accompanied by changes in their armament. As the equality of the old freemen gave place to the classification of the people into lords, gentlemen, and serfs, corresponding distinctions in arms and equipment followed; the horseman became the representative of the upper classes, the foot soldier of the serfs and peasants. The feudal system could only be maintained by the superior fighting power of the ruling class. All that money and art could do was therefore lavished on the equipment of the lord and his immediate retainers, while the peasant remained ill-armed and comparatively defenseless. The strength of armies was measured by the number of men-at-arms. Efforts to arm and train the mass of the people commonly originated with the kings, in their desire to form a more national force than the semi-independent feudal levies, and received small encouragement from the nobles. When they succeeded it was a sign of weakness in the feudal chiefs, and of a more popular government. In no country were the lower orders so warlike and used to arms as in England; and historians have showed how essentially popular was the rule even of our most absolute monarchs.

Two characteristics of feudalism were especially adverse to progress in military art; the undue preponderance given to one arm, numerically weak; and the impossibility of unity of action or combined organization among so many independent and rival authorities. Among the causes tending to bring about a better military system must be reckoned the *Crusades*, those marvellous efforts of fanaticism that still excite a wonder and admiration mixed with pity. It is true they left no mark at all proportionate to the vastness of the efforts. The armies of the Crusaders, as they took the field, were mere tumultuary masses, as destitute of order and discipline as their leaders were ignorant of military science. But for the first time large bodies were kept continuously under arms, and some sort of organization necessarily developed itself. The knights and leaders becoming conscious of their own numerical weakness, bestowed more care on the arms and discipline of their men and learned their value; and the first true infantry of the feudal times dates from the Crusades.

The fall of feudalism as a military system, though gradual, as all such changes are, may be said to have been accomplished in the middle of the 15th century.

Two events occurring about that time gave it its death-blow—the defeat of the Burgundian chivalry by Swiss infantry in three successive battles of Granson, Morat and Nancy; and the establishment of “*compagnies d’ordonnance*” by Charles VII. of France. The first destroyed forever the overwhelming prestige attached to the mailed horsemen, and restored infantry to the place which it had held in ancient armies, and has never lost since; from the second dates the origin of *standing armies* in Europe. Charles VI. had already sought to substitute a permanent national force for the foreign mercenaries, who were as great a curse to their employers as to their enemies, but the attempt was interrupted by his insanity, followed immediately by internal discord and disastrous wars with England. It was not till sixty years later that Charles VII., having fully established his power by a series of successes over the English, carried out his father’s idea, and (in 1445) organized fifteen “*compagnies d’ordonnance*,” to be maintained in peace as well as in war. Each company consisted of 100 men-at-arms, or “lancers,” with their attendants, viz., squire, groom and batman, and three archers—the whole force amounting to 9,000 men. Three years later he organized a corresponding force of infantry, 16,000 strong, named franc-archers. The superiority of a standing army over an assemblage of feudal militia was soon proved, and other states imitated the example of France. A change took place in the military system of Europe; the practice of calling out the feudal contingent ceased, and permanently paid troops, regularly disciplined and organized, were substituted for them. These troops were not always national. At first they were largely composed of the old bands of wandering mercenaries; but the proportion of foreigners decreased as the feudal spirit gave way to a more national one.

The development of the new system may be dated from the beginning of the 16th century. Armies, no longer undisciplined feudal levies, were permanently organized in companies and in regiments. The use of firearms became general, though it was long before the pike was entirely supplanted. The distinctive duties and value of cavalry and infantry were recognized, and regular tactics introduced for the different arms, the battalion (originally *battaglia*, battle array) becoming the recognized tactical unit for infantry, as distinguished from the administrative organization by regiments and companies. “Articles of war” were issued to their several armies by Ferdinand of Spain, Francis I. of France, and Charles V., and a regular discipline thus established. From this time to the outbreak of the great French Revolution but little change took place in the manner of raising armies, though their technical organization varied according to the arms in use. Armies were raised mainly by voluntary enlistment, compulsory levies being only resorted to under pressure of war. Usually the king or his commander-in-chief contracted with a nobleman, of repute as a warrior, or large possessions, to raise a regiment—the nobleman to receive a certain sum down and an annual allowance for its maintenance, and to have the command of it. He in his turn engaged “captains,” some of whom brought companies with them, others raised companies under his authority, and others, again, merely commanded the men he himself had raised. Royal officers, “commissaries,” were appointed to muster these regiments periodically, and see that the colonels fulfilled their share of the contract; and, on the other hand, to issue the pay and provide for the subsistence of the forces. The regiments were sometimes raised

for a fixed time, and disbanded at the expiration of that time or at the close of the war; but as standing armies became general, they were maintained permanently, the command being transferred as occasion required; and, as the terms of the contract were always favorable to the colonel, the command of a regiment was a valuable piece of court patronage. The earliest form of organization, both in the cavalry and infantry, was the company, originally representing the group of men who followed a knight to battle and fought under his banner, and later the bands of mercenaries who served under a “Captain.” These companies were afterwards grouped and organized in regiments, but for a long time each company continued to carry its own banner, indicating its real origin. Both companies and regiments varied in strength according to the habits of the country, and according to the wealth or personal influence of the leaders. In the days when men fought in compact masses, and one man’s voice could thus control a large number, 500 and even 600 men was not an uncommon strength for a company; and in some nations the numbers never fell very low.

As the undisciplined *melée* of feudal battles gave way to regular and scientific tactics, the necessity of bodies of constant and uniform strength was felt, and the battalion and squadron were introduced as the *fighting* formations of infantry and cavalry respectively. Originally battalions were dense masses numbering several thousand men, and composed of many regiments. As changes in arms led to the adoption of more extended formations, it became necessary to subdivide into smaller fractions, and battalions were gradually reduced in size till they became mere fractions of a regiment. Finally, when the advantages of uniform and permanent organization were more fully understood, and large standing armies enabled such improvements to be introduced, regiments also were made of uniform strength, and the battalion became a fixed fraction, usually one-half or one-third of a regiment, but still retained its distinctive character as a tactical unit; while for administrative purposes, recruiting, clothing, payment, etc, the regiment was the unit. Similarly, the company remained the lesser administrative unit,—that is, the captain was answerable for the pay, equipment, and discipline of his company in camp and quarters.

The tactical changes effected in European armies between the beginning of the 16th and end of the 18th centuries, consequent on alterations in arms, need only be very briefly noticed here. In the earlier wars of the 16th century musketeers formed but a small proportion of the infantry, and the great bulk consisted of pikemen, whose power lay in weight and mass; deep formations were consequently the rule. The cavalry still fought principally with the lance. In the latter part of the century, during the great war of independence of the Netherlands, improvements in firearms led to the proportion of musketeers being increased, and the front of battle proportionately extended to give effect to their fire. The cavalry also adopted firearms, and were taught to trust more to fire than to the effect of the charge.

The bayonet, introduced about the middle of the 17th century, gradually superseded the pike, and led to a further reduction of the ranks. During the prolonged wars of Louis XIV.’s reign, and under the auspices of the great generals of that age,—Turenne, Condé, Eugene, and Marlborough,—the permanent grouping of battalions and regiments into brigades and divisions was first introduced. Still further improvements were made during the Silesian and Seven

Years' War (1740-63). Many changes ascribed to Frederick the Great are really due to Leopold of Dessau, who, under the first Frederick, formed the army which the second Frederick led to victory. He reduced the ranks of the infantry to three, trained them to manœuvre rapidly and with extraordinary precision, and was the author of the drillbook which has remained the basis of all European systems of drill. But the improvements in cavalry tactics were unquestionably due to Frederick himself, who taught them the true secret of their strength, shock and rapidity, and further developed their power by the introduction of horse artillery, able to move rapidly and accompany the cavalry anywhere.

Such was the military condition of Europe when the French Revolution broke like a storm over the continent, sweeping away old landmarks and old systems, covering the land for years with a flood, which, when it receded, left the whole face of the country changed. When, in 1792, the monarchs of Europe banded to crush the revolution, the military force of France was at a very low ebb. The old Royalist army was disorganized by revolutionary passions and frequent changes, and the constituent assembly had rejected the proposed "compulsory service" as at variance with the liberty of the citizen. But on the proclamation that "the country was in danger," volunteers flocked from all parts to join the armies, and a levy *en masse* was ordered to repel the invaders. Within three years nearly 1,200,000 men were thus poured into the army, and sufficed to repel the invaders, and form the armies which, under Hoche, Moreau, and finally under Bonaparte, brought France forth victorious in 1797.

In 1798, Jourdan brought forward and passed the law establishing *conscription*, the basis of all French military legislation since that date, and more or less of that of other countries also. Every citizen was declared liable to service for five years, and the whole male population, between the ages of twenty and twenty-five, was divided into classes and enrolled by name, to be called out as occasion required. It was the terrible power of the conscription that enabled Napoleon to carry on the gigantic wars which characterized his reign, and after losing in the snows of Russia the largest army ever put in the field, to reappear in a few months with another almost as large. Other nations of necessity followed the example of France, and the conscription became general. Prussia still further developed its power by reducing the period of service in the ranks, and passing her soldiers as soon as sufficiently trained into a reserve, thus gradually training the whole of her population. The "short service and reserve" system, the greatest revolution ever effected in this branch of military art, and characterized by a recent foreign writer on political economy as "the greatest, and in its ulterior consequences probably the most important, of the events of our century," owed its origin to the conditions imposed on Prussia by Napoleon at the treaty of Tilsit. Restricted to an army of 43,000 men, the Prussian statesmen evaded the spirit of the clause by sending the trained soldiers to their homes, to be recalled when needed, and replacing them with recruits. This system, by which every citizen becomes also a trained soldier, and there is no limit to the size of the armies save that of population, was at first only partially adopted by other countries. The prejudice in favor of professional armies—soldiers whose business it was to fight, and do nothing else—was too strong, and doubts were felt whether these semi-citizen armies would stand the rough trials of war. But after

Sadowa, other nations had no choice but to copy it or resign their military position. It is true the lesson was not learned at once by all, but 1870 and 1871 enforced what 1866 had already taught; and within the last few years every great continental power has reorganized its military institutions on the model of Prussia.

If we glance back at the history of military institutions in Europe since the fall of Rome, we find it divides itself into four well-defined periods. In the first or barbarous stage we have vast armies or hordes, formidable from their numbers and the courage of the warlike freemen composing them, but almost without tactics or organization. In the second or feudal period we have armies nearly as numerous, but whose strength lay entirely in a small body of highly equipped knights and men-at-arms—the bulk of the army no longer freemen fighting for their country, but slaves fighting at their lord's command. In the third or "standing army" period we have small armies of highly trained professional soldiers forming a class distinct from the rest of the population, tactics and organization becoming a science and making vast progress. Lastly under the conscription we have armies once more national, embracing the whole male population, more numerous than ever, but now trained and organized with all the science and skill of professional soldiers. Some remarks on the general principles involved in this branch of military art will serve as introduction to a more detailed account of existing armies.

The military institutions of a nation are governed by various considerations, the principal of which are geographical position, policy, national character, and wealth. A country like America, which is threatened by no powerful neighbors, can devote its whole energies to peaceful pursuits, and reduce its army to a mere police force. But a European state, surrounded by warlike and powerful nations, may depend for its very existence on its army, and must consequently keep pace with its neighbors, and develop its forces to the utmost that industrial and economical considerations admit of. Political economists class all military expenditure as non-productive. Perhaps it might more fairly be called indirectly productive, as necessary to the maintenance and extension of civilization, and the protection and development of trade. Further, the value of property increases with increased security, and military expenditure within certain limits thus tends to repay itself. Broadly, however, it may be treated as a tax for insurance, and as so much withdrawn from the productive power of the nation. The object of all military institutions is to develop the highest amount of fighting power—that is, attain the greatest security with least strain on the industry of the country—the latter being measured, not by the cost of the army as shown by the budget, but by the amount of productive labor withdrawn and disturbance produced. All questions, therefore, have to be considered under two aspects, military and economical—that of efficiency and that of cost.

The first question that presents itself is the manner of raising armies. There are two methods,—that of voluntary enlistment, and that of compulsory levies or conscription: the former once the universal system, but now retained by England alone; the latter adopted by all other European powers. By voluntary enlistment the burden of military duty is distributed evenly throughout the community, the soldier receiving fair wages for his service, while the citizen bears his share in the form of taxes. Personal liberty is not interfered with, the industry of the country generally is undisturbed, those members only are withdrawn who

are likely to contribute least to its wealth, and the army becomes a useful school and refuge for the restless classes of the community. But the supply of recruits is fluctuating and uncertain, they are drawn almost entirely from the lowest class, every desired improvement is hampered by considerations of its effect on recruiting, and the army tends to become a class rather than a national one. Compulsory service gives unlimited command of men, introduces a higher class in the ranks, and raises the tone of the army generally; while military efficiency alone has to be considered in organization. But it presses much more severely on the country. Military service becomes a tax inflicted by lot, falling with excessive weight on some, while others escape free.

The next great question is that of the terms of service. No nation can afford to keep constantly under arms the whole force which it may require to put forth in war. In olden times fresh armies were raised on the outbreak of each war. The great step in modern organization was the maintenance of permanent *cadres* and the formation of trained reserves. Military forces are now divided into "standing armies," comprising those who are actually doing duty as soldiers, and forming in peace time the cadres and the school of instruction of the army; and "reserves," under which name are included all who pursue their industrial callings in peace, but are called to arms in war. Such reserves, however, may be of very different value, from the Prussian "reservist," a trained soldier in the prime of life, to the *garde mobile* or volunteer who has only attended a few drills; and their value is always closely connected with the system and terms of service. There are practically three systems. The first, or *long service* system is now almost obsolete,—it partly lives in England alone. Under this the soldier was engaged for life, or for a long term of years, remained with the colors so long as fit for service, and was then discharged, usually with a pension. It produced a highly-trained army, in which discipline, mutual reliance, *esprit de corps*, constancy under discouragement, and all soldierly qualities, were carried to their highest pitch. The soldier made the regiment his home, and knew no law but the word of his commander. But such an army was necessarily small, being maintained in peace as well as in war, and could form no reserve, as all remained with the colors till they were no longer fit for service. In war, therefore, it had to be increased, and its casualties replaced by untrained recruits; and its quality deteriorated when excellence was most required. Long service also tended to produce a class army, isolated from the life of the nation, and always a dangerous weapon in the hands of an unscrupulous ruler.

The converse of this is the second, or *militia* system, actually in force in Switzerland and Canada, and to a certain extent in America. Under this no permanent army is maintained, but all, or a large proportion, of the inhabitants are liable to service, and undergo a partial training. The cost of such a force is very small, the industrial disturbance reduced to a minimum; yet the forces that are put in the field are formidable, in numbers at least.

The third and intermediate system is that of *short service and reserves*, now adopted by all nations. The European details of its application vary, but the general principles are the same in all,—to maintain the cadres of a large army in peace, capable of expansion in war, and to keep the recruit in the ranks only so long as is necessary to make him a trained soldier, and then pass him into a reserve. It combines the numerical strength of the militia system with the organiza-

tion, training and discipline of a long service army. The principles of *organization* are comparatively simple. Organization is of two kinds, tactical and administrative; the first having reference to action on the battle-field, the second to general maintenance in peace as well as in war. Originally the two were often distinct; thus companies and regiments were originally administrative units, battalions tactical ones; and the two had not necessarily any connection. But the most perfect organization is that which answers both purposes, and in this direction all modern improvements have tended; and as the battle-field is the ultimate objective of all preparation, administrative considerations must give way to tactical ones when they clash, and all organizations must conform to the tactical requirements of the day.

The first "mixed divisions," *i. e.*, divisions comprising troops of all arms, were formed in the revolutionary armies of 1792, and in 1804 Napoleon organized "*corps d'armée*," each forming a complete army in itself, under the command of a marshal,—the necessity for such organization arising from the size of his armies, which had grown beyond the immediate control of one man. This organization was copied by other armies, and attained its highest perfection when combined by the Prussians with their territorial system—each *corps d'armée* being permanently located in and recruited from a particular province. A modern army usually comprises several such *corps d'armée*.

BRITISH ARMY.

The supreme command of all the military forces of the nation is vested in the crown, but can only be exercised through an intermediate and responsible agent. The entire administration, therefore, of the regular army and reserve or auxiliary forces is under the control and responsibility of the *secretary of state for war*, who is assisted by two under-secretaries, the *parliamentary* and *permanent* under-secretaries of state. The actual army administration is divided among three great officers,—the officer commanding in chief, the surveyor-general of ordnance, and the financial secretary. These officers are at the head respectively of the three great departments of the war office, *viz.*, the military department, the control department, and the financial department. Any or all of the above mentioned great officers may be in parliament; and the surveyor-general of ordnance and financial secretary have usually seats in the lower house.

The officer commanding in chief is nominated by a letter of service, and holds his appointment during her majesty's pleasure, differing in this respect from the surveyor-general and financial secretary, who are appointed by the secretary of state, and removable at his pleasure. He is assisted in his duties, and his orders are conveyed and executed through the agency of the *general staff* of the army, comprising the headquarter staff of the military department of the war office, and the general officers holding commands at home or abroad, with their subordinate staffs. The headquarter staff is subdivided into the *adjutant-general's* department, under the adjutant-general to the forces, a general officer of high standing, who is named directly by the sovereign, and is the chief staff officer of the commander in chief, and the channel through which all communications connected with the personnel, military operations, duties, discipline, and general efficiency of the army pass; the *quartermaster-general's* department, under the quartermaster-general to the forces,—a general officer of subordinate

rank to the adjutant-general, but also appointed by the sovereign—whose duties embrace the movement and quartering of troops, roster of regiments for foreign service, and military questions connected with barracks; the *military secretary's* department, under the military secretary to the commander in chief, who is the channel of correspondence on all matters connected with the appointment, promotion, exchange, and retirement of officers, and honors and rewards; the *intelligence department*, including the topographical department, under a deputy-adjutant-general, charged with the collection and registering of all strategical, statistical, and topographical information, whether relating to the British Empire or to foreign countries and armies; the *recruiting department*, under an inspector-general of recruiting, charged with the supervision of the recruiting throughout the kingdom; the *auxiliary forces department*, under an inspector-general of reserve and auxiliary forces, embracing all questions connected with the militia, yeomanry, volunteers, and army reserves; and the *military education department*, under the director-general of military education, charged with the instruction and examination of officers, and matters connected with military colleges and regimental or garrison schools and libraries. The artillery and engineers have a distinct headquarter staff, subordinate, however, to the adjutant-general.

The surveyor-general of the ordnance is appointed by the secretary for war, and removable at his pleasure; the appointment is, therefore, a political one, and usually connected with a seat in parliament.

The financial secretary is appointed by the secretary for war, and removable at his pleasure; the appointment, like that of the surveyor-general, is therefore a political one, and usually connected with a seat in parliament. He is assisted by an accountant-general and large staff of clerks in his department of the war office, but has no staff or subordinates outside its walls.

The number of men to be maintained and the amount of money to be expended are determined by an annual vote of parliament, based on the *estimates* laid before the house by the minister of war. The minister, with the advice of the officer commanding in chief, decides on the number of men that parliament shall be asked to provide for the ensuing year, and the estimates are framed accordingly.

The whole of the military forces of England are raised by voluntary enlistment. Recruiting for the army is carried on partly by means of the large staff of non-commissioned officers attached to the brigade depôts, partly by means of pensioners receiving a special rate of pay while so employed, and partly by sergeants or parties sent out by regiment and corps for the purpose—the whole being under the superintendence of the colonel commanding the brigade district.

On the completion of twelve years' army service, soldiers may be allowed to re-engage for nine years, making a total of twenty-one, at the end of which they are entitled to discharge with a pension. Those who are passed into the army reserve remain liable for the rest of their twelve years' engagement to be recalled into the ranks in case of war or national emergency, and to be called out for eight days' training in each year; but otherwise resume their positions as citizens, and are free to follow their callings.

A recruit for the army must be between 18 and 25 years of age, unmarried, free from physical infirmities, and of such height and chest measurement as may be laid down from time to time. The standard has fre-

quently varied, having been used as a means of regulating the supply of recruits, but stood in 1873 at a minimum of 5 feet 5 inches for the infantry, 5 feet 6 inches for light cavalry and engineers, 5 feet 7 inches for gunners, and 5 feet 8 inches for heavy cavalry; the minimum chest measurement being 33 inches. For rifle regiment and for artillery drivers the standard is reduced to 5 feet 4½ inches, but increased chest measurement is required. Exceptions are also made in favor of artificers and others. No recruit, however, is finally accepted until he has been examined by a medical officer, and approved by an officer of rank detailed for the purpose. Formerly, recruiting was carried on largely at public houses kept for the purpose; young men were entrapped by lying placards or by the misrepresentations of recruiting agents, and often enlisted while drunk, and then sent under escort to their regiments. Recently great improvements have been made in the recruiting service: the bounties formerly offered, and varying from £1 to £10, according to the demand for recruits, have been abolished, exaggerated placards forbidden, the recruiting taken away as much as possible from the public houses, and the young soldier sent by himself to join his regiment. Under the system of long service the annual number of recruits required to keep up the army was from 8 to 10 per cent. of its strength, but in future the proportion will be largely increased. The average number actually raised annually was 16,000 in the ten years 1860-9, and 21,000 in the three years 1870-2; the largest number raised in any one year since the Crimean war being 28,000, in 1859.

There are ten ranks of combatant officers in the army,—viz., field-m Marshals, generals, lieutenant-generals, and major-generals (classed as *general officers*); colonels, lieutenant-colonels, and majors (*field officers*); captains, lieutenants, and sub-lieutenants (regimental or *company officers*). The classification and promotion of officers is complicated by the system of *brevet* or *army rank*, by which an officer may hold a higher rank in the army than he holds in his regiment. Brevet rank is usually given for distinguished service in the field, or for length of service; it begins with the rank of major, and may be said to cease with that of major-general, as in that grade and in those above it all rank is army rank. Relative rank and command within the regiment, regimental promotion and duties, and pay, are determined by regimental rank; but rank, command, and duties outside the regiment, and army promotion are governed by army rank.

Previous to November 1871, first appointments and regimental promotion in the cavalry and infantry were made under the purchase system. The system dates from the earliest days of the army, and arose partly from the mode in which regiments were originally raised. Every regimental commission had a fixed regulation price, varying from £450, the price of an ensigncy in an infantry regiment, to £7,250, that of a lieutenant-colonelcy of life guards; in addition to which an over-regulation price, which sometimes even exceeded the regulation-price, had sprung up, and become established by custom, though contrary to law. An officer on retiring received the regulation price of his commission from government, and the over-regulation from the officer who succeeded him; and the step went to the senior qualified officer of the lower grade in the regiment who was able and willing to purchase it. An officer who could not afford to purchase rose with the others till he became senior of his rank, and there remained till a death vacancy or other "non-purchase step" gave him his promotion. Practically, however, the injury inflicted was less than at

first sight appears, as the purchase system stimulated a rapid flow of promotion, by which the non-purchase officer profited also, and if he lost a year or two in promotion, he saved several thousand pounds. First appointments were given to gentlemen whose names were on the commander in chief's list, and to cadets from the military college at Sandhurst, on passing the required examinations and paying the price of the commission; a certain number of commissions without purchase being given to those who passed high examinations at Sandhurst, and to young men whose father's services gave them special claims.

Purchase was abolished by warrant of July 20, 1871, parliament voting the money to compensate the officers then holding salable commissions, and a system of promotion by "seniority tempered by selection" was substituted by the present regulations.

GERMAN ARMY.

By the "constitution of the German empire," bearing date of April 16, 1871, the land forces of all the states of Germany form a united army under the command of the emperor. The German army thus includes the contingents of Prussia, Bavaria, Saxony, Württemberg, Baden and a number of minor states, all raised and organized (with insignificant variations) on the Prussian model. The peace strength of the army in 1901 was 604,468 officers and men, or about 1 per cent. of the population; and the budget is established on the basis of 257 thalers, or £38, 11s., per soldier present with the colors. The army is organized in 18 army corps, of which 14 are furnished by Prussia and the states whose contingents are amalgamated with hers, 2 by Bavaria, 1 by Saxony and 1 by Württemberg. As the Prussian army thus constitutes three-fourths of the military forces of the empire, and is the model on which not only the other contingents, but to a certain extent the armies of most European powers, have been formed, a detailed account of its organization will serve as an introduction to the necessarily brief notices of the other armies of Europe.

The Prussian army, like the monarchy, is of comparatively recent origin. Its European reputation dates from the wars of Frederick the Great, but it was his father, Frederick William I., aided by Prince Maurice of Dessau, who really created the army which Frederick II. led to victory, and which numbered 70,000 men, admirably trained and equipped, when the latter ascended the throne.

The infantry had been especially perfected by Prince Maurice; and under Frederick's care the cavalry soon rivaled, if it did not excel it. The gallant struggle against overwhelming odds, and the series of brilliant victories which marked the Seven Years' War, raised the reputation of the army to the highest pitch; and the superb force of 200,000 men which he bequeathed to his successor was justly accounted the best in Europe. It was hardly, however, a national army, and its excellence was owing rather to Frederick's genius, and to his system of discipline and instruction, than to the goodness of the material. The cavalry, it is true, and the hussars especially, were recruited almost entirely from the Prussian states, and from the sons of the small farmers or better class peasants; but the infantry was raised from all sources, and was largely composed of foreigners, deserters, and vagabonds of all kinds. With Frederick's death, the genius which had animated it, and which alone gave value to such heterogeneous materials, was gone. It still retained its imposing appearance and precision of movement, and its overweening self-confidence. But at the first encounter with the armies of Napoleon it

fell to pieces; and after a series of crushing defeats, Prussia found herself at the feet of the conqueror, shorn of half her territory, obliged to receive French troops in all her towns and fortresses, and only existing as it were by sufferance. But in these very disasters were laid the seeds of her future greatness. By the treaty of Tilsit the Prussian army was limited to 43,000 men. This limitation suggested to Scharnhorst what was known as the "krumper," or "short-service" system already described. The bitter humiliation and suffering endured under the French yoke aroused a national spirit which was capable of any sacrifices. Every Prussian was eager to be trained to fight against the oppressor of his country; and when Prussia rose in 1813, the armies she poured into the field were no longer mercenaries, but national armies, imperfectly trained and organized it is true, but animated by a spirit which more than compensated for these defects. At the close of the war her rulers, with far-seeing sagacity, at once devoted themselves to organize on a permanent footing the system which had sprung up under the necessities and enthusiasm of the moment. The conscription, compulsory personal service, and a three years' term in the ranks, with further periods in the reserve and landwehr, were then introduced; and though variations have subsequently been made in the distribution of time, the principles were substantially the same as those now in force. By the law of 1814 the periods of service were fixed at three years in the army, two in the reserve, and fourteen in the landwehr, and the annual contingent at 40,000 men. As the population increased, it was felt that the service was unequally distributed, pressing unnecessarily heavy on some, while others escaped altogether. Further, the experiences of 1859, when Prussia armed in anticipation of a war with France, aroused great doubts as to the efficiency of the landwehr, which then formed the bulk of Prussia's forces, and of whom many had been as long as ten years away from the colors. Accordingly, by the law of 1860 the annual contingent was fixed at 63,000, the period in the reserve was increased from two to four years, and that in the landwehr reduced from fourteen to five. The total armed force thus remained nearly the same (12 contingents of 63,000, in place of 19 of 40,000), but the army and its reserves were more than doubled (increased from 5 x 40,000 to 7 x 63,000) while the landwehr was proportionately reduced.

This change was not effected without great opposition, and led to a prolonged struggle between the king, guided by his able and ambitious minister Bismarck, and the parliament; for some time the king ruled and levied taxes in open defiance to parliament and the constitution; and it required the brilliant success of 1866, and the position thereby won for Prussia, to reconcile the nation to the new law.

By the present "military law of the German empire," every German is liable to service (*wehrpflichtig*), and must render such service personally. Neither substitutes nor purchase of exemption are allowed; and those who are physically unfit for the ranks may be required to render such other services—as hospital attendants, tradesmen, etc.—as they are capable of. Every German capable of bearing arms belongs to the army for seven years, commencing at the age of 21, and afterwards to the landwehr for five years. Army service is divided between the ranks and the service, three years being spent in the former and four in the latter. The annual contingent of recruits is not now permanently fixed, but is determined by the number required to keep up the peace establishment, and is estimated at from 120,000 to 130,000

annually. By fixing the total peace establishment instead of the annual contingent, the authorities have gained the power of largely augmenting the army without raising the budget or attracting public attention, as by passing men into the reserve before their time they can always increase the contingent required to complete the regiments, and thus the total number of trained men available in war. Thus, before the war of 1870, commanding officers of regiments were directed to send home a certain number of the most intelligent men after two years' service; and since the war a large proportion of the infantry have been subjected to two years' training only.

The military organization of Germany is based on the territorial divisions of the empire. With the exception of the Prussian guard corps, which is recruited generally throughout the kingdom, each army corps has a corps district (*Besirk*) within which it is raised, recruited and stationed.

At the beginning of each year lists are prepared from the parish registers of all young men who have attained their twentieth year, and to these lists are added the names of those who though still liable to service have been allowed to stand over from previous years.

The system of exemptions is so elastic that practically the recruiting commission can select, by a process of elimination those best fitted for service, and abolish the element of chance. A margin of about 10 per cent., however, is usually allowed; those who draw the lucky numbers are passed into the *Ersatz* reserve, but remain liable for a year to fill any accidental vacancies in the peace establishment.

The men drawn for the army are then told off to the different branches of the service; men with good chests and good feet to the infantry, men accustomed to horses to the cavalry, gamekeepers and foresters to the rifles, men of high standard to the guard, those of inferior physique to the train, carpenters and mechanics to the engineers, and a certain proportion of shoemakers, tailors, saddlers, etc., to all regiments and corps. The final decision and allotment to regiments is usually completed about September. From that time the men are called recruits, and amenable to military law, but are given passes until the 15th of October, the date on which they join their regiments.

These conscripts form the great bulk of the army; but there are other classes, also, serving under varied conditions. Of these the most important are the "one year volunteers," young men of means and education, who, on condition of passing certain examinations and bearing all expenses of clothing, equipment, etc., are allowed to pass into the reserve after one year's service only. This system is a great boon to the middle and professional classes, who thus materially reduce the interruption which the full term in the ranks would cause in their education; and every effort is made to render the service as light as is consistent with thorough instruction.

After completing his term in the ranks the soldier is passed into the reserve, retaining, however, his place in his regiment, borne on its books, and liable to be recalled to it in case of war. The *reservist* is supposed to take part in at least two manœuvres, not exceeding eight weeks, during his term of reserve service. On completing his seven years' army and reserve service he leaves his regiment and passes into the landwehr and is taken on the lists of the corresponding landwehr battalion for the remaining five years of liability. The landwehr battalion is the basis of the local organization, both for recruiting and mobilization. As a rule, to each three-battalion regiment of the line is

attached a two-battalion landwehr regiment. These two are connected as closely as possible; they bear the same number, the line regiment draws its recruits from the battalion districts, furnishes the staff for their cadres, and passes its men into their ranks.

THE IMPERIAL ARMY.

The imperial army is divided into 18 army corps, and in 1901, on its peace footing, consisted of 24,145 officers, 580,023 rank and file, 104,485 horses, and about 1,500 guns. The grand total of 591,955 men comprises 166 regiments of infantry, 327,930 men; 21 battalions of jäger or riflemen, 12,219 men; 93 regiments of cavalry, 67,370 men; 52 regiments of artillery, 61,600 men; 21 battalions of engineers, 12,906 men; 18 battalions of military train, 6,372 men; and 3,558 other officers and men. On its war footing, the total is about 3,000,000 men, besides the landsturm. The estimated cost of the army for 1901 was \$107,413,000, ordinary and extraordinary.

PRUSSIAN ARMY.

The Prussian army is divided into *field troops*, who in peace time form the standing army and the school of instruction in arms for the nation, and in war time, augmented by the reserves, become the active army; *depôt troops* (*Ersatztruppen*), who have no existence in peace time, but in war time are formed of cadres supplied from the field troops, and filled up by recruits and reserve men, and whose duty it is to maintain the active army at full strength; and *garrison troops* (*Besatzungstruppen*), principally formed of the landwehr, and existing only in cadre in peace time, but who are embodied and take up the garrison duties and home defense when the active army takes the field, and also occasionally reinforce it.

The total peace strength of the 14 army corps composing the Prussian army in 1901 was:

	Men.	Horses.	Guns.
Field Troops			
Depôt Troops			
Garrison Troops			
.....	446,115	82,085	1,938

FRENCH ARMY.

From the earliest times the inhabitants of Gaul were distinguished for bravery and enterprise. First as enemies and afterwards as subjects and auxiliaries, they played an important part in the great wars of Rome; and though they yielded to the irruption of the Franks, the admixture of races seemed only to heighten the warlike spirit of the nation. Under Charlemagne, and, later, in the Crusades, and under Philip Augustus and St. Louis, the chivalry of France especially distinguished itself. The excessive power and independence of the great vassals, however, long prevented the formation of any permanent national force, and made France a prey to intestine wars and foreign invasions. Charles VII. availed himself of the lull which followed the final expulsion of the English in the middle of the 15th century to organize his *compagnies d'ordonnance*, and thus laid the foundation of a national standing army. But the armies that followed the kings in their wars still consisted mainly of foreign mercenaries, hired for the occasion; and the creations of Charles and his successors fell to pieces during the religious wars. Louvois, war minister of Louis XVI., was the true creator of the French royal army. On his accession to power, the king's guards, some squadrons of *gendarmerie*, and a few infantry regiments (afterwards distinguished as the "old"), constituted the whole of the standing

army. All other forces had to be created at the outbreak of a war, being usually raised under contracts allotted to generals and others. Louvois first transferred the army from the hands of contractors and speculators to those of the king. He abolished the *arrière-ban*, and substituted a money tax for the liability to service, thereby obtaining funds for the maintenance of a regular army. In 1672, after ten years of his administration, Louis XIV. was able to take the field with a force of 91,000 infantry, 28,000 cavalry, and 97 guns, all permanently organized troops, the largest national army that had yet been seen; and six years later the military forces of France had been raised to nearly 280,000 men. The last half of the 17th century is a brilliant period in the annals of the French armies. Organized by Louvois, animated by the presence of the great king, and led by Condé, Turenne, Luxembourg, Catinat and Vendôme, they made head against coalitions which embraced nearly all the powers of Europe, and won a series of victories that extended the bounds of France, and made her for a time the first military nation of Europe. But after the death of Louis XIV. the French army gradually deteriorated. In the Seven Years' War it was disgracefully defeated. Under the reign of Louis XV. confusion and maladministration prevailed everywhere, and the highest idea of military art was to copy servilely every minute detail of the Prussian army. The higher officers, usually nobles about the court, seldom went near their regiments; and Madame de Genlis relates how, when young courtiers departed to join their regiments for a few weeks' duty, the ladies of the court decked them with scarfs and favors, as if proceeding on a distant and perilous expedition.

Under Louis XVI. the army improved somewhat; the American war and the successes of LaFayette and Rochambeau revived a more warlike spirit; instruction was more carefully attended to, a good system of drill and tactics was elaborated at the camp of St. Omer, and attempts made to reform the administration. But the revolution broke over France in the midst of these attempts at reorganization; the old royalist army disappeared with the monarchy, and was merged in that revolutionary army which under a new flag was destined to raise the military fame of France to its greatest height.

If Louvois was the creator of the royal army, Carnot was so of the revolutionary army. At the outbreak of the revolution the royal army consisted of 105 infantry regiments of two battalions each, 14 rifle battalions, seven regiments of artillery, and 62 regiments of cavalry, numbering about 173,000 in all, but capable of augmentation in war strength to 210,000. To this might be added a provincial or militia force of about 60,000, but nominal rather than real. At the very outset it was deemed necessary to reorganize and augment this army. Voluntary enlistment under the system of *rassembleurs* or "bringers," by which the army had hitherto been fed, was found insufficient. "Compulsory service" was proposed in 1789, but rejected as "contrary to the liberty of the citizen." An appeal was then made to the patriotism of the nation, and 200 battalions of volunteers were enrolled; but though many presented themselves, and these volunteers contained much of the best blood and highest intelligence of France, the numbers fell far short of the expectations, and the proportion that reached the frontier was small. In the winter of 1792-3 the French armies, notwithstanding the unexpected successes of the preceding campaign, seemed on the point of dissolving altogether, and the convention was driven to order a compulsory levy of 300,000 men.

In August 1793 the affairs of France were at their lowest ebb. Its armies had been driven from the Rhine and out of Belgium, and a dangerous insurrection had broken out in La Vendée. The compulsory levy, slowly and imperfectly carried out, had not yielded the full number; and those that were obtained deserted by hundreds. The nominal strength amounted in all to 480,000 men, but one army with a paper strength of 90,000 had really only 33,000 in the ranks, and the others were little better. Under the new system of promotion commands changed almost daily, and fell into the hands of men who had never before been entrusted with more than a section, and confusion reigned everywhere.

Such was the position when Carnot, then a captain of engineers, was called to the ministry of war. A few days later a levy *en masse* of all the male population between the ages of 18 and 25 was ordered, and was carried out with more method and success than former levies. The muster-rolls of the armies filled rapidly, and by the end of the year the effective force had risen to 770,000. The amalgamation of the old army and the volunteers, which had been commenced, but imperfectly carried out, was effected on a different and more thorough principle; the white uniform, distinctive of the old days of royalty, was abolished, the infantry organized in demi-brigades of three battalions (usually one of the old army to two of volunteers), and the men and cadres intermixed within the demi-brigade. A permanent organization in divisions, composed of all arms, was introduced, and able officers selected for the commands. Jourdan, Hoche, Pichegru, Kleber, Moreau, were at the head of the armies of the republic. Arsenals and manufactories of warlike stores were created; schools of instruction were established; the republican forces were transformed from hordes to armies, well disciplined, organized and equipped. The enemies of France were defeated at all points; and in tracing the plan for the campaign of 1794 Carnot showed that his genius shone in strategy as much as in administration. Himself of an almost Roman type of character, —severe, but a true patriot and republican,—he had succeeded in infusing much of his own spirit into the army; he had given it not merely discipline and organization, but honor and soldierly feeling. When Moreau promulgated to his army the decree of the convention, which forbade them to give quarter to any Englishman or Hanoverian, he added, in general orders, "I have too high an opinion of French honor to believe that such an instruction will be obeyed," and he was right.

In the year 1796 Napoleon appeared on the scene, and by a series of brilliant victories enlarged the frontiers of France and secured a glorious peace. But the exhaustion of years of continuous warfare had made itself felt; the armies were reduced to mere skeletons, and no sufficient means existed of replenishing them, till in 1798 the *conscription* was introduced. From that time there was never a dearth of men; the whole male population of France was practically at her ruler's disposal; and Napoleon had full scope for his genius in organizing these masses. His principal improvements were effected in the interval between the peace of Amiens and the war with the third coalition, while threatening the invasions of England. His armies were collected in large camps on the coasts of the Channel, and there received that organization which, with minor variations, they retained, during all his campaigns, and which has since been copied by all European nations. The *divisions*, as organized by Carnot, consisted usually of two brigades (twelve

battalions) of infantry, two regiments of cavalry, and two or three batteries of artillery. Napoleon grouped two or three divisions into *corps d'armée*, commanded by marshals. He withdrew the whole of the cavalry and a portion of the artillery from the divisions, and with the light cavalry and batteries so obtained formed a reserve corps under the immediate orders of the corps commander; while he kept the whole of the heavy cavalry, amassed in cavalry divisions, his guards, and a certain proportion of artillery, in his own hands, as a reserve to the whole army. Thus was organized that "grande armée" which immortalized itself at Ulm, Austerlitz, Jena, Friedland, Wagram, and Borodino; and after planting the tricolor on every capital in Europe, perished at last in the snows of Russia.

The frightful expenditure of life during Napoleon's war almost drained France of her manhood, and his frequent calls on the country made the name of the conscription detested. One of the first acts of the restoration was to abolish it. In 1855 the law of "dotation" or exemption by payment was passed, and put an end to personal substitution. The state now undertook to provide substitutes for all who paid a fixed sum, and did so by high bounties to volunteers or to soldiers for re-engaging.

Changes had also taken place in the constitution of the army. On the restoration its numbers were reduced to 150,000, the old regiments broken up and recast, and a royal guard created in place of the old imperial one. When the revolution of July 1830 had driven Charles X. from his throne the royal guard, which had made itself peculiarly obnoxious, was dissolved; and under Louis Philippe's reign the army was augmented to about 24,000 with the colors. Under the provisional government of 1848 it was further increased, and in 1854, when France allied herself with England against Russia, the army was raised to 500,000 men. The imperial guard was recreated, and every effort made to revive the old Napoleonic traditions in the army. In 1859 Napoleon III. took the field as the champion and ally of Italy, and the victories of Montebello, Magenta and Solferino raised the reputation of the army to the highest pitch, and for a time made France the arbiter of Europe. But the campaign of 1866 suddenly made the world aware that a rival military power had arisen, which was prepared to dispute that supremacy. From this time a trial of strength between France and Prussia was looked forward to as inevitable, and both sides prepared for the coming struggle. Niel, the then war minister of France, saw clearly that the organization which had with difficulty maintained 150,000 men in Italy, was no match for that which had within a month thrown 250,000 into the very heart of Austria, while waging a successful war on the Maine against Bavaria and her allies. In 1867, therefore, he brought forward a measure for the reorganization of the army, by which he calculated to raise the military force to 800,000 men—half of them with the colors and half in reserve—besides forming a separate army for home defense in case of need. It is not necessary to dwell on the law of 1868, for it remained but two years in real operation. To complete Niel's scheme many years were required; but Niel himself died within a year, and the next year saw the French army annihilated, or existing only as prisoners of war in Prussia.

At the outbreak of the Franco-German war the French field troops consisted of 368 battalions, 252 squadrons and 984 guns. The strength of the entire army on peace footing was 393,000 men; on war footing, 567,000. The forces immediately available for the war on the Rhine were estimated at 350,000,

but they actually fell short of 300,000. They formed 8 *corps d'armée*, each composed of from two to four infantry divisions and one cavalry division,—making a total of 26 infantry divisions of 13 battalions each, 11 cavalry divisions of from 4 to 7 regiments each, and 756 guns. Within seven weeks the whole of this army, with trifling exceptions, was either captive in Germany or hopelessly shut up in Metz. But the spirit of the nation rose to the occasion, and though, as the result proved, extemporized armies can do little against veteran ones, the efforts of the people and the creative energy of her rulers will always command admiration. The next year's contingent of recruits was called out and hastily trained. Fourth battalions were formed from the *dépôt cadres* and organized into *régiments de marche*. The *gardes mobiles* were mobilized, and by successive decrees and under various names nearly all the manhood of the country called to arms.

The regular troops raised as *régiments de marche*, etc., amounted to 213,000 infantry, 12,000 cavalry, and 10,000 artillery. The *garde mobile* exceeded 300,000, and the mobilized national guard exceeded 1,100,000—of whom about 180,000 were actually in the field and 250,000 in Paris; the remainder in camps or *dépôts*. Altogether the new formations amounted to nearly 1,700,000, and if to that be added the army existing at the beginning of the war, the total forces developed by France during the struggle reach the enormous amount of 2¼ millions.

According to the new law, which received further development from subsequent legislation (especially in 1888), every Frenchman twenty years old, if not infirm, or exempted from service for educational reasons, must enter the army and serve three years in the active army, six in the reserve, six in the territorial army, and ten in the territorial reserve. Rifles, guns, and all the necessities of warfare are kept in readiness for nearly 4,000,000 men. Nearly 300,000 young men are called out every year, and more than 200,000 enter the ranks. The army numbers 541,000 men, and has 136,000 horses in time of peace. But in case of war it can be raised to 2,500,000 men; and 1,250,000 men more all having received military training, may be added to the above.

AUSTRIAN ARMY.

The imperial army of Austria may be said to date from the Thirty Years' War. Long before that, Maximilian I. had established a corps of "kyrissers" (original of the modern cuirassiers), and taken into his pay a considerable force of "lands-knechts," the early German infantry. But the latter were companies engaged for the war only, and disbanded at its termination; and it was not till the reign of Rudolph II. (about 1600) that any permanent regiments were formed. Even these can hardly be counted as belonging to the imperial army, for the men composing them were only indirectly subject to the sovereign, and really obeyed their own chiefs, who could transfer their services to other powers. It was Wallenstein who first raised a distinctly imperial army of soldiers owing no duty but to the sovereign; and it was the suspicion that he intended to use this army, which was actually raised largely at his own expense, to further his own ends, that led to his assassination. From that time the regiments belonged no longer to their colonels, but to the emperor; and the oldest regiments in the present Austrian army date from the Thirty Years' War. At the close of the war Austria had 19 infantry and 7 cavalry (6 cuirassier, 1 dragoon) regiments. Half a century later her forces had in-

creased to 40 regiments of infantry and the same of cavalry; and in 1809, when she put forth her whole strength for the great struggle with Napoleon, she had 61 infantry regiments (46 German and 15 Hungarian) and 45 of cavalry. Up to the beginning of this century, her armies were recruited almost entirely by voluntary enlistment; but, like all the other powers, she was compelled to follow the example of France, and have recourse to the conscription during the great revolutionary wars. During the half-century which intervened between the final overthrow of Napoleon and her struggle with Prussia for supremacy in Germany, various minor alterations were introduced, but in the main her military system remained as it was at the close of the great war. The conscription continued in force, the period of service being fixed at ten years, eight of them in the ranks and two in the reserve; unlimited furloughs, however, were granted, and the actual service in the ranks seldom exceeded six years, and was often reduced to two or three in the infantry. The disastrous war with Prussia in 1866, and the new constitution finally granted in 1867, led to an entire revision of her military institutions in the following year, and her present organization is based on the law of 1868.

The armed forces of Austria consist of the *standing army*, which in peace time, on a reduced footing, serves as a school for training the nation to arms, and in war time, completed by its reserves, forms the field army; the *landwehr*, which in war time acts as a support to the field army and provides for home defense; the *Ersatz reserve*, from which casualties in the field army are replaced; and the *landsturm*, a national levy only called out to resist invasion. The war establishment of the standing army is fixed at 800,000; the peace establishment varies, being governed by financial considerations, but is usually about 250,000.

RUSSIAN ARMY.

Of all European powers, Russia maintains by far the largest army. In 1870 its peace establishment amounted to three-quarters of a million, and its war establishment to a million and a quarter; and when the changes which were commenced in that year have taken full effect, her available war strength will be increased to nearly two millions. But even this enormous force is not excessive when measured by the vast extent of her possessions (7,500,000 square miles), or her population (82 millions); it is calculated that a levy of 25 per cent. of the young men coming annually of age will suffice for the requirements of the army, and that military service will thus fall more lightly in Russia than in any other great nation of the continent.

The military resources of Russia thus consist of the *active army*, or men serving with the colors; the *reserves*, who have completed their period in the ranks, but rejoin the army in case of war; the *irregular troops*, or Cossacks; and the *national legions*, or armed levies, only called out in exceptional cases, such as invasion. The regular army is formed by the active army, completed in time of war from the reserves, and is divided into *field troops* and *local troops*,—the former furnishing the armies for the field, the latter the garrisons, and the depôts at which the recruits are assembled and trained, and whence the field troops are fed. The local troops, as their name implies, are permanently localized; the field troops are not, as in Prussia, connected with certain districts, but draw their recruits indiscriminately from the whole empire, and are moved from one part to another as occasion demands.

The field troops of the regular army consist of 612 battalions of infantry, 236 squadrons of cavalry, 16 battalions of sappers and engineers, and 306 batteries of guns and mitrailleuses.

Local Troops.—That portion of the Russian army which is stationary in peace is distinguished by the name of "local troops;" and these again are divided into "reserve and depôt troops and troops for service in the interior." The reorganization of these forces was commenced in 1873, and has taken some years to complete.

The total strength of the "local troops," when the new organization has been completed will amount to about 784,000 men and 816 guns.

The irregular troops or Cossacks have always borne a most important share in the wars of Russia. In 1812 more than 100,000 were raised, and the services they rendered in that and following campaigns made their name famous and a terror throughout Europe. In 1856 they raised 184,000 men, of whom about three-fourths were cavalry; but the Crimean war did not give the opportunity of utilizing this class of troops.

ITALIAN ARMY.

The Italian army consists of 80 regiments of the line, 10 of *bersaglieri* (riflemen), 20 regiments of cavalry, 10 of artillery, and 2 of engineers. A regiment of the line consists of 3 battalions of 4 companies each, and numbers about 1,500 men on peace and 3,000 men on war footing. Eight of the existing regiments are grenadiers. The *bersaglieri* are formed in regiments of four battalions each and are picked troops, armed with a shorter rifle, and especially trained to traverse long distances at a run.

The total strength of the Italian active army on peace and war footing is approximately as follows:—

	Peace.	War.
Infantry, 80 regiments.....	128,000	245,000
Bersaglieri, 10 ".....	18,000	36,000
Cavalry, 20 ".....	18,000	21,000
Artillery, 10 field regiments.....	11,000	21,000
" 4 garrison ".....	6,000	13,000
Engineers, 2 regiments.....	4,000	7,000
Train, 3 ".....	2,500	10,000
Staff administration, etc.....	3,500	8,000
	191,000	361,000

In war time this force is organized in 20 divisions, forming ten army corps,—each corps comprised of 24 infantry battalions, 4 *bersaglieri* battalions, 2 cavalry regiments, and 10 field batteries, giving a fighting strength of 28,000 infantry, 2,000 cavalry, and 80 guns. The corps and divisional organization is not permanent in peace time; but the divisional staffs are kept up in those of 16 territorial and 4 active divisions maintained in peace.

SPANISH ARMY.

In 1867 the total armed forces of the kingdom (including navy and colonial troops) were fixed at 200,000. The land forces in Spain itself amounted to 150,000, of whom 80,000 belonged to the regular army, and the remaining 70,000 were made up of *carabineros* or gendarmerie, *guardia civil*, and provincial militia. The total strength of the army, exclusive of reserves, is about 38,000 men; the number serving with the colors varies according to the time of year.

SWEDISH AND NORWEGIAN ARMY.

Although the crowns of Sweden and Norway are now permanently united, each country retains its own government, constitution and laws; and the military forces of the two countries are separate and differently organized. The Swedish army is composed of

three distinct classes,—the “värfrade,” or enlisted troops, to which belong the royal guards, one regiment of hussars, the artillery, and the engineers; the “indelta,” or national army, paid and kept by the landowners, each of whom furnishes a certain number of men, to whom, besides a small annual pay, a cottage and a piece of land are allotted during the period of service; and thirdly, the “beräring,” or conscription troops, drawn by annual levy from the male population between the ages of 20 and 25 years. The “indelta” are called out for a month’s training annually in time of peace. Besides the above, there is a Gothland militia force of 30 companies of infantry and 3 batteries of artillery, numbering about 8,000 men; these, however, are not compelled to serve beyond the confines of the isle of Gothland, and have a separate command. The royal guards number 2,240, the line (under which is included the “indelta”) about 25,000 infantry, 5,000 cavalry, 5,000 artillery with 234 guns, and 1,000 engineers. The “beräring” amount to about 95,000 of all arms. The Swedish troops are physically the finest in Europe,—powerful, hardy, and brave, and retaining much of the old Scandinavian heroic spirit; and, though strictly a militia only, their peculiar aptitude for all warlike exercises would make them formidable antagonists, even to the best trained armies. Few nations have so brilliant a military history. Under Gustavus Adolphus in the Thirty Year’s War, and later under the heroic but insatiate Charles XII., they achieved a reputation almost unrivalled in Europe; and their armies and tactics served for many years as models to the great military powers.

The military forces of Norway are differently organized, and though divided into line and militia, are in fact purely a militia force. By the law of 1867 all young men past the age of 21 are liable to the conscription, with exception of the inhabitants of the three northern provinces, who are free from all military service. Actually the troops are raised partly by voluntary enlistment and partly by conscription. The term of service is for ten years, divided into three in the line, four in the reserve, and three in the militia or “landvaern.” The *cadres* of the army are formed entirely of volunteers.

Of these, however, the landwehr exist on paper only, and may be left out of consideration; and the available force is estimated at about 105,000, of whom 70,000 belong to the “auszug,” and 35,000 to the reserve.

AMERICAN ARMY.

The army of the United States of America is the last that calls for notice. Threatened by no powerful or warlike neighbors, the United States are saved from that ruinous competition in armaments which presses on the industry of European countries. The American army is little more than a police force, of which a few regiments serve as a reserve to the civil power in the great towns, while the rest are dispersed in small posts along the frontiers or among the Indian districts. By an Act of 1901 its strength was limited to 100,000 men. It consists of ten regiments of cavalry, each of twelve companies or troops; twenty-five regiments of infantry, of ten companies each; five regiments of artillery, and one engineer battalion. The cavalry, broken up in small detachments, partake more of the character of mounted police than of that of European cavalry. They are armed with swords and breech-loading or repeating rifles, and trained to act on foot as well as on horseback; and the whole cavalry drill is assimilated as closely as possible to

that of the infantry. The infantry is organized into ten company regiments, each company having a maximum size of 100 men. The word battalion is a word of convenience, meaning more than one company and less than one regiment, and often, as on parade in prescribed words of command, it may mean simply the regiment entire, or the two or three regiments or bodies of troops, not brigaded, there present. The army is raised entirely by voluntary enlistment; the term of service was three years, but it has recently been extended to five, and re-engagements are encouraged. Two regiments of cavalry and four of infantry are composed of negro soldiers, but commanded by white officers. The officers of the army are furnished by West Point Academy, a military school equal to any in Europe. The course of instruction lasts four years, and includes all subjects of general education besides purely professional ones. West Point is sought by young men of the best families in America, and the number educated there formerly exceeded the requirements of the army. It is thus the means of spreading a certain military education throughout the country, and it was to this West Point training that the Southerners owed the large number of excellent officers that were found in their ranks in the war.

For military purposes the territory of the United States is divided into ten departments, and those grouped into four military divisions: the South, comprising the departments of the South and of Texas; the division of the Missouri, comprising the departments of Dakota, the Platte, and Missouri; the division of the Pacific, comprising the departments of Columbia, California, and Arizona; and the division of the East, comprising the departments of the East and the Lakes.

By the constitution of September 1787 the President is Commander in chief of the army and militia of the Union, and Congress has power to raise and support armies, to make rules for their government and regulation, and to provide for calling forth the militia to execute the laws of the Union, suppress insurrections, and repel invasions.

The military history of the United States is as strange as the rise and rapid growth of the nation. In 1790 the rank and file of the army, as fixed by the Act of Congress, amounted to 1,216 men; and in 1814 an English expedition of only 3,500 men was able to seize and burn Washington, the capital of a country which even then numbered eight millions of inhabitants. In 1861, at the commencement of the war of the secession, the whole regular force amounted to only 14,000 men. In April of that year the President called out 75,000 volunteers for three months to defend the capital, which was threatened; and in May a further call for 42,000 was made. In July two calls for 500,000 each were authorized by Congress, and as even this vast force proved insufficient for the gigantic struggle which America had now embarked in, it was found necessary to introduce the conscription. In October, 1863, a levy of 300,000 men was ordered, and in February, 1864, a further call of 500,000 was made. Finally, in the beginning of 1865 two further levies, amounting in all to 500,000 men, were ordered, but were only partially carried out in consequence of the cessation of hostilities. The total number of men called under arms by the government of the United States, between April, 1861 and April, 1865, amounted to 2,759,049, of whom 2,656,053 were actually embodied in the armies. If to these be added the 1,100,000 men embodied by the Southern States during the same time, the total armed forces reach

the enormous amount of nearly four millions, drawn from a population of only 32 millions,—figures before which the celebrated uprising of the French nation in 1793, or the recent efforts of France and Germany in the war of 1870–71, sink into insignificance. And within three years the whole of the vast forces were peacefully disbanded, and the army had shrunk to a normal strength of only 30,000 (in 1902) 80,000 men.

In this article much has been said of the causes productive of the changes which finally produced the great armies of the world as we now know them. It is remarkable that the United States constitutes the extraordinary exception to almost all that has been said of the armies of more than two thousand years. Several of the technical definitions of "army" have been given at the beginning of this article. But these too, fail when applied as meanings of "army" in the United States. Here the terms most distinctly understood would be these: An army, an armed force, is any number of armed men large or small, not acting in personal self-defense or for the voluntary redress of personal grievances, *authorized by law and under command of an officer of the state*. To us, then, the idea of an army is embodied practically in a sheriff's posse, or in a body of deputy sheriffs, enrolled and sworn upon an hour's notice, in any county of any State in the Union. This acts effectively within the county of the sheriff's jurisdiction in all respects as a military force. It may, and does, suppress insurrection, repel trespass or invasion in any form, enforce the laws, protect property, and by armed intervention keep the peace. It may march, camp and fight, using all the means and appliances known to organizations strictly and technically military. Every year, in almost every State, these organizations spring into existence, perform their functions and retire almost unnoted. In many instances they have equalled or excelled in numbers and efficiency the gathered farmers who enlisted the British troops at Lexington, and as was not then the case, they act as a force under the authorization of established law. It follows then that the military organization of this country is unique, that the prime military power is in the hands of the sheriff of every county, that a county may organize, equip and maintain an army for itself, and may officer and maintain it indefinitely during any emergency.

To this may be added the statement that even the governor of a State may not interfere with the functions of the commanding officer of this miniature army until notified by him that a stronger force than the county can raise is peremptorily required for the emergency. Sometimes these emergencies last only an hour; sometimes for days or weeks. Sometimes able-bodied citizens are drafted wherever found and instantly enrolled and armed. Still more frequently they enlist by scores or hundreds, and become a force it would be folly to resist because of the spirit and purpose of the organization. When the idea is followed to its logical sequence it will be seen that the military force of the United States depends actually, and must always depend, upon the volition of its citizens, who are nearly all civilians, but who may when they wish, incited by any vital emergency, become all soldiers. Without this volition no powerful armament can possibly be organized, no lengthened military operations be maintained. That which makes a sheriff's posse must also make an army. That which was a county emergency must be a general one. The regular forces, infinitely small in proportion to population, and themselves in time of peace a police force only, have their real purpose in the maintenance

of the technical and professional knowledge necessary in large affairs and actual war. In addition to them, existing for the same purposes, and one grade above the sheriff's force is the State militia, large or small, efficient or not, at the option of the State. In the regular force is to be found ideally that which military men call *discipline*; the habit of unquestioning obedience in emergency. This is, strangely enough, capable of distribution when necessary, and it is depended upon to make real soldiers out of volunteers. The great military school at West Point serves its entire actual purpose in keeping alive in the trained minds and bodies of some two thousand men in a population of seventy millions a technical knowledge of the art of war.

In all the emergencies of the United States thus far this unexamined military system, not originally planned by the wisdom of men but the logical result of a democracy in which there is no taint of feudalism, has been successful. Its great purpose is that it shall be adequate for all the purposes of self-defense and the perpetuation of national rights and that it shall be impossible to use its enormous aggregate power for any other purpose. These ends by the will of the people seem to be absolutely secured. The story, the old story of almost all the wars of all history, must here be reversed. No single party, no clique, no family, no man, can in this country bring about the calamity of war, and such an event can only come by a well-nigh unanimous consent of all those who do the fighting and who pay the costs. That consent is either spontaneous or it is not given at all, and argument is useless. Meantime the tax-eating battalions are not included among our economies and necessities. We have no standing armaments to gnaw at our industries and eat away our national life, and it is more than probable that all the perils, frequent changes, and uncertainties of a government by the people are amply compensated for by the facts adduced in any reflection upon the article "army" as such facts exist in the United States.

ARMY-WORM, a name sometimes given in Europe to the grubs of a small black fly (*Sciara militaris*), very common in some European forests. In the United States the name is given to the larva of the *Leucania unipuncta*, a voracious moth, common everywhere.

ARNAUD, HENRI, the celebrated pastor, military leader, and historian of the Vaudois, was born, in 1641, at La Tour, or La Torre, in Piedmont. He is said to have served under William of Orange, and it is probable that he received pecuniary assistance from that prince in his efforts to restore the exiled Vaudois to their native valleys. Owing to the cruelties of Victor Amadeus of Savoy, from two to three thousand of these Vaudois had been forced to take refuge in Switzerland and the states along the banks of the Rhine; and twice they ineffectually attempted to return to their home. But the English Revolution of 1688, and the accession of William of Orange to the throne, encouraged Arnaud to make a grand effort. Concentrating about 900 followers in the great forest of the Pays de Vaud, he remained in concealment for some time; and at last embarked with them on the Lake of Geneva on the night of 16th August 1689. By September 16 they had entered the valley of San Martino, after hard fighting with the French and Savoyard troops that harassed and opposed them. Being now, however, in danger of attack from about 20,000 French and Piedmontese troops, they were obliged to repair to the lofty tableland of the Balsille, which they fortified with such skill as to be able to withstand the fiercest attacks of the enemy, repeatedly renewed through the whole winter.

A general assault on the Balsille (2d May 1690) by about 22,000 French was an utter failure, resulting in the decimation of the enemy, without the loss of a single man to Arnaud. Not caring to hazard a renewal of the assault, the garrison withdrew from this stronghold to Angrona, where, just when all chance of further escape seemed impossible, they learned that hostilities had broken out between France and Piedmont, and that their king, who had persecuted and expelled them, was now ready to receive them with open arms. Thus ended the "glorieuse rentrée des Vaudois dans leurs vallées," effected, according to their own account, with a loss of only 30 men, while they made out that the joint losses of the French and Savoyards fell little short of 10,000 men. For a while the Vaudois were allowed to remain in peaceful possession of their ancient homes; but when the war of the Spanish Succession broke out, Arnaud and his followers took part in the combination against France, and rendered the allies effectual service. When the war came to a close, the ungrateful king of Piedmont once more joined the French monarch against his own subjects, and complied with the demands of that prince, that the Vaudois should be expelled from some of their valleys. The exiles, amounting in all to about 3000, found an asylum in Würtemberg. Arnaud, who had invitations from William III., and might have spent the remainder of his days in ease and honor in England, chose rather to continue the pastor of the exiles in the village of Schönberg, and wrote, in his retirement, the *Histoire de la glorieuse Rentrée des Vaudois dans leurs Vallées*. It was printed in 1710, and dedicated to Queen Anne, and has been twice translated into English. Arnaud died at Schönberg in 1721, and every memorial that he left behind him was long cherished by his followers and their posterity.

ARNAUD, or ARNOLDUS, DE VILLA NOVA, a physician, alchemist, and astrologer, who lived at Paris about the end of the 13th and beginning of the 14th centuries. The discovery of the three principal acids,—sulphuric, nitric, and hydrochloric,—has been attributed to him, but Hoefcr has shown that these had all been discovered long before his time.

ARNAULD, ANGÉLIQUE (called Angélique de Saint-Jean), niece of the first or great Angélique, was born in 1624. She was educated at Port-Royal, and took the veil in her twentieth year. In 1653 she was made sub-prioress. During the persecution of the Jansenists, from 1661 to 1664, she was the chief support of the nuns in their resolute refusal to sign the Formulary of Alexander VII. Along with some others she was put into confinement, and, even after permission had been given to return to Port-Royal, they continued to be under the close surveillance of soldiers, who were not withdrawn till 1669, after the "peace" edict of Clement IX. In 1678 Angélique was elected abbess, which office she continued to hold till her death in 1684. See ARNAULD, JACQUELINE MARIE.

ARNAULD, ANTOINE, one of the greatest French theologians and philosophers, was born at Paris, Feb. 8, 1612. He received his first instructions in theology from Lescot, confessor of Richelieu, but his teacher's influence over his mind was greatly weakened by the study of some works of Augustine, which, at the request of his mother, had been recommended to him by St. Cyran. The thesis which he presented for the degree of bachelor in 1635 showed manifest traces of Augustine's influence, and gave great offence to Lescot. Arnaud now entered the Sorbonne, and from 1638 to 1640 professed the courses of theology and philosophy requisite for a licence. In 1641 he was ordained priest, and took his degree of doctor. After being twice rejected on foreign grounds, or, perhaps, from the hostile influence

of Lescot, he was, in 1634, admitted a member of the Society of the Sorbonne. In 1641 his mother died. Her last words, in which she implored him to hold steadfastly by the truth, made a deep impression on his mind. He gave up several benefices which he had obtained, and resolved to devote himself with all his soul to the defence and propagation of what he believed to be the truth. Between 1641 and 1643 he composed a treatise in two vols., *De la Necessité de la Foi* (not published till 1700), and another, *Théologie Morale des Jésuites*. In August 1643 he published his famous work, *De la Fréquente Communion*, expressly directed against the Jesuits, who held that the mere mechanical reception of the sacraments was sufficient, and that previous preparation and actual repentance were of secondary importance. They had even gone the length of saying, that the more a man sinned the more frequently and boldly should he approach the table of communion. Arnaud's book was sanctioned by many doctors of the Sorbonne, and by several bishops and archbishops. It was denounced by the Jesuits, one of whom, by name Nouet, preached against its heretical tenets, and called Arnaud an heresiarch worse than Calvin or Luther. This, however, carried matters too far; the Sorbonne and the bishops, who had given their sanction, were implicated in such a condemnation, and, by their influence, Nouet was compelled to retract. But the Jesuits insisted that the work must be judged at Rome, and laid special stress on a sentence in the preface, due not to Arnaud, but to De Barcos. This sentence they held to be adverse to the Papal supremacy, and they so wrought upon Mazarin as to obtain from him a decree commanding Arnaud and De Barcos to repair to Rome. Such intense excitement and indignation were roused by this decree, which struck a blow at the freedom of the French Church, that Mazarin apologised and withdrew it. De Barcos, who had made preparations for his journey to Rome, now learned that the Jesuits were forming bolder and more dangerous designs against Arnaud and himself. He withdrew into concealment and warned Arnaud, who followed his example. The book was examined at Rome and defended by Bourgeois, a doctor of the Sorbonne; and only the one sentence in the preface fell under Papal censure.

Scarcely was this controversy over, when a fresh cause of trouble arose. In 1640 appeared the *Augustinus* of Jansen, bishop of Ypres, the great object of which was to show that the doctrines of Augustine on grace, free-will, and redemption, were opposed to those of the Jesuits, which were really semi-Pelagian. This work fell under Papal censure in 1642, in the bull *In eminenti*, which condemned it as a revival of the errors of Bajus. Arnaud, in 1643, wrote some observations and considerations on the bull, and in 1644-45 a first and second apology for Jansenius. For a time there was little opposition made by the Jesuits, and Arnaud, besides superintending at Port-Royal, occupied himself in translating into French some of Augustine's works, and into Latin his own treatise *De la Fréquente Communion*. At last, in 1649, one Cornet proposed to the Sorbonne seven propositions which he maintained to be heretical. Of these, five were drawn from the *Augustinus* of Jansen. The other two propositions were allowed to drop, and after much controversy the five were condemned by a Papal bull in 1653. Two years later the duc de Liancourt, whose chaplain was a Jansenist, and whose granddaughter was an inmate of Port-Royal, was refused absolution by a Jesuit confessor unless he dismissed his chaplain and withdrew his granddaughter from the heretical community. Arnaud wrote two letters upon this affair—the first anonymously, the second signed with his name, and addressed to the duc de Luynes. In this sec-

ond letter it was stated,—1st, that the fathers of the church exhibit to us, in St. Peter, a saint who was deficient in saving grace; 2d, that the five heretical propositions were not contained in the *Augustinus*. This second statement contains the celebrated distinction of the questions “de jure” and “de facto.” As a matter of right,—of faith,—the propositions were heretical, wherever they occurred, but as a matter of fact, they were not to be found in Jansen’s book in the sense ascribed to them by his opponents. The Jesuits held that this was really a rejection and defiance of the Papal bull; and, in 1656 they prevailed on the Sorbonne to expel Arnauld, deprive him of his doctorate, and pass a decree to the effect that all future members of their body must sign the censure. Arnauld’s defence against this decree was undertaken by Pascal, who, in his brilliant *Provincial Letters*, brought down the dispute to the level of public comprehension. Arnauld continued to live in retirement, and, in company with Nicole, composed the valuable Port-Royal treatises on grammar, logic, and geometry. In 1668 the peace of the church allowed him to emerge from his retirement. He was received with great honor, and devoted himself to defending Jansenism from the imputation of leading to Calvinistic heresy.

In 1679 Arnauld was again compelled to conceal himself. He fled from France, and, pursued by the enmity of the Jesuits, went from Mons to Tournai, thence to Ghent, from Ghent to Brussels, and, after having been driven into Holland, settled at Brussels from 1682 to 1690. In 1690 he was again compelled to leave his refuge, but, after wandering about for four years, returned to Brussels, where he died on the 8th August 1694.

ARNAULD, JACQUELINE MARIE (better known by her religious name, Marie Angélique de Ste. Magdeleine), born 8th September 1591, was the second daughter of Antoine Arnauld, the celebrated advocate. She was early destined for the church, and assumed the dress of a novice in 1599. By concealing her age from the Pope, her father obtained a bull nominating her abbess of Port-Royal when she was little more than eleven years old. For some time after entering on office she spent a purely secular life, performing the needful religious exercises, but taking little or no interest in them, and gradually acquiring an intense dislike to the profession she had adopted. At last, in 1608, a sermon preached in the convent chapel produced a great change in her mind. She now saw that her true duty and happiness lay in the work of the convent; she inflicted on herself severe penances, persuaded the nuns to adhere rigorously to their vow of poverty, and excluded even her own relatives from the cloister precincts. The fame of the reformation wrought by her earnestness spread abroad, and when Mme. d’Estrées, abbess of Maubuisson, was, on account of her gross misconduct, removed and sent into confinement among the *Filles Penitentes* at Paris, Angélique was appointed to take charge of the convent. From this she was forcibly ejected by Mme. d’Estrées, and had to be reinstated by a body of the royal archers. For five years she labored in Maubuisson, and wrought a considerable change in the state of the convent. In 1623 she returned to Port-Royal, and three years later, as their accommodation became too limited for their numbers, the community removed to the house known as Port-Royal de Paris. In 1648 she, with a few companions, went back to Port-Royal des Champs, and there had opportunities for showing much kindness to the poor, who were oppressed by the disastrous civil wars. Angélique died in 1661, just before the great storm of persecution broke over Port-Royal.

ARNDT, ERNST MORITZ, a distinguished German patriot, poet, and historical and miscellaneous writer, was a native of the island of Rügen in the Baltic, which at the time of his birth belonged to Sweden. He was born at Schoritz on the 26th December 1769. The second of a family of eight, he inherited from his father the sound mind in the sound body, good sense, practical sagacity, warm feeling, and a strong will; and from his mother the earnest, devout, and Christian spirit which animated all his words and deeds. After passing his boyhood in his father’s house, familiar with the solitudes of sea and wood, trained in habits of accurate observation and cheerful activity, and stimulated by books to literary attempts of his own, he was sent, in 1787, to the gymnasium of Stralsund. There he studied for two years, and, after spending the next two years in the old home, he entered, in the spring of 1791, the university of Greifswald, whence he removed to Jena. There he fell under the influence of Fichte, whose teachings he received with eager love, and whose memory remained ever dear to him. Destined for the church, he applied himself at first to the study of theology, but after some years, conscious of no inward call, he renounced that pursuit. In 1796 he became a private tutor at Altenkirchen; visited afterwards Austria, Hungary, Italy and France, giving to the world the fruits of his observation in a series of remarkable volumes published in the course of the following years; and in 1800 settled at Greifswald as “privat-docent” of history and philology. In 1806 he was named professor extraordinary. His special faculty and vocation distinctly revealed themselves in his bold *History of Serfdom in Pomerania and Rügen* (1803), for which he was denounced by the nobles to the king of Sweden. So convincing was the book that, in 1806, serfdom was abolished. In his next work, *Geist der Zeit* (1807), he aimed at a higher mark. He flung down the gauntlet to Napoleon I. who, in the campaigns of Austerlitz and Jena, had laid Germany prostrate before him, and in burning words he called on his countrymen to rise and shake off the hateful yoke. So great was the excitement produced by this appeal that Arndt, to escape the vengeance of Napoleon, took refuge in Sweden. The work passed through fifteen editions, and grew into four volumes, to which a fifth part, entitled *Pro Populo Germanico*, was added in 1854. Arndt, having thus erected the banner of German freedom and unity, devoted himself thenceforth with unflinching courage to the great cause. In pamphlets, poems, and songs he communicated his own enthusiasm to his countrymen; and he zealously co-operated with Stein in the reorganisation of the army and preparation for the final struggle. The War of Liberation followed, and Germany was free. Long years were, however, to pass before unity was attained. One of the most famous of Arndt’s songs was that commencing, “*Was ist der Deutschen Vaterland*.” The revolutionary outbreak of 1848 rekindled in the venerable patriot his old hopes and energies, and he took his seat as one of the deputies to the National Assembly at Frankfurt. Seeing no prospect of a satisfactory issue he retired with the adherents of Von Gagern. With rare freshness and vigor he continued to lecture and to write, and on his 90th birthday received from all parts of Germany good wishes and love-tokens. About a month later, January 29, 1860, he made a peaceful departure out of the world.

ARNDT, JOHN, was a famous Protestant theologian of the 16th century, and may be regarded as the founder of the German Pietism of a later generation. He was born at Ballenstädt, in Anhalt, in 1555, and studied in a variety of universities—in Helmstädt in 1576; in Wittenberg in 1577, when the crypto-Calvinist controversy

was at its height, and where he took the side of Melancthon and the crypto-Calvinists; in Strasburg, under Pappus, who was a strict Lutheran and had a great influence over him; in Basel, where he studied theology under Sulzer, and also medicine. In 1581 he went back to Ballenstädt, but was soon recalled to active life by his appointment to the pastorate at Badeborn in 1583. After some time his Lutheran tendencies exposed him to the anger of the authorities, who were of the Reformed church. He found an asylum in Quedlinburg, and afterwards was transferred to St. Martin's church in Brunswick.

ARNE, THOMAS AUGUSTINE, musical composer, was born in London on the 28th May 1710. In 1733 he produced his first work,—a setting of Addison's *Rosamond*, the heroine's part being intended for his sister, who afterwards became celebrated as Mrs. Cibber. This proving a success was immediately followed by a burletta, entitled *The Opera of Operas*, based on Fielding's *Tom Thumb*. His individuality of style first distinctly asserted itself in the music to Milton's *Comus*, which was performed at Drury Lane in 1738, and speedily established his reputation. In 1740 he wrote the music for Thompson and Mallet's *Masque of Alfred*, which is noteworthy as containing the most popular of all his airs—*Rule Britannia*. In 1759 he received the degree of Doctor of Music from Oxford. Three years later he produced, at Covent Garden, his opera of *Artaxerxes*, the popularity of which is attested by the fact that it continued to be performed at intervals for upward of eighty years. The libretto was a translation by Arne himself, very poorly executed, of Metastasio's *Artaserse*. In addition to his numerous operas, Arne wrote several oratorios, which made little impression at the time, and are now almost entirely forgotten. Dr. Arne died on the 5th March 1778.

ARNHEM, or ARNHEIM (according to some the *Arenacum* of the Romans, Arnoldi Villa in the Middle Ages), the chief town in the province of Guelderland, in the Netherlands, on the right bank of the Rhine along the slope of the Veluwe Hills. Pop. (1901), 57,498.

ARNICA. A genus of plants belonging to the natural order *Composite* (composite family). The flowers are clustered in heads (*capitula*), and are surrounded by an involucre composed of two rows of small leaflets called bracts. It yields an essential oil in small quantity, and a resinous matter called arnicin. Arnica has been used as a stimulant in low fevers, and also in cases of palsy. It is said also to act in promoting perspiration. It is a popular remedy for chilblains, and it is said to prevent the blackness of bruises. The flowers have also been used in the form of tincture. They have an unpleasant odor.

ARNIM, BETTINA VON, famous for her acquaintance and correspondence with Goethe, was a member of the Brentano family, and born at Frankfort, April 4, 1785. Her acquaintance with Goethe continued from 1807 until 1811, when it was brought to a close by her offensive behavior to his wife. Shortly after his death she published an extensive correspondence alleged to have passed between the parties. Its genuineness was immediately contested by Goethe's old friend Riemer, and the discussion leaves no doubt that it is everywhere interpolated, and to a great extent wholly fictitious. Bettina never could produce the originals of the letters; and it has been demonstrated that the sonnets which she claimed as addressed to herself, and as partly versifications of her own ideas, were in fact addressed to Minna Herzlieb before Goethe had even seen Bettina. This discovery effectually relieves the poet's memory from some very unpleasant imputations. The literary merits of the work are considerable. She died in 1859.

ARNIM, or ARNHEIM, JOHAN GEORG BARON VON, one of the most distinguished men during the period of the Thirty Years' War, both as a general and as a diplomatist, was born in 1586, at Boitzenburg, in the province of Brandenburg. He entered the Swedish army, and served under Gustavus Adolphus. In 1626 he, though a Protestant, was induced by Wallenstein to join the imperial army. He gained great distinction by his military and diplomatic talents, and became the close friend and faithful ally of Wallenstein. After the dismissal of the latter from his command in 1630, Arnim went over to the elector of Saxony, and at the battle of Leipsic, led the left wing of the united Saxon and Swedish armies. But he disliked the Swedes, who distrusted him; and it was mainly by his influence that the elector detached his forces from Gustavus Adolphus, and that at the peace of Prague the Saxons seceded from their alliance with Sweden. In 1632 Wallenstein, who had been restored to his command, took the field against his old comrade, but little was done by either, and more than a suspicion was roused that they were playing into each other's hands. In February 1634 Wallenstein was assassinated, and Arnim at once began more active operations. In May he gained a great victory over the imperialists at Liegnitz; but after the conclusion of peace, not thinking himself sufficiently honored by the elector, he withdrew to his castle of Boitzenburg. Here he was seized by the Swedes, and imprisoned at Stockholm. He escaped, and was engaged in raising an army to revenge himself when he died suddenly in 1641.

ARNIM, KARL OTTO LUDWIG VON, a German writer of travels, was born at Berlin in 1779, travelled from 1835 to 1844 through Turkey and Greece, France, Spain, and Italy, and died in 1861. His reputation rests mainly on his *Flüchtige Bemerkungen eines flüchtigen Reisenden* (1838–1850), which are highly praised for their lively and graceful style.

ARNIM, LUDWIG ACHIM VON, a distinguished German poet and novelist, was born at Berlin in 1781. He spent some years in travelling through parts of Germany and collecting old popular legends and songs. A selection of these he published at Heidelberg in conjunction with the poet Clemens Brentano, whose sister Bettina (noticed above) he afterwards married. His literary activity was for some time interrupted by the war in Germany, but in 1817 he published his last great romance, *Die Kronenwächter*, the scene of which is laid in the time of the Emperor Maximilian. Arnim died in 1831.

ARNISEUS, HENNINGUS, a German physician, was born at Halberstadt, probably about 1580. In 1613 he was appointed one of the professors of medicine at Helmstädt, and he is said to have constructed there a chemical laboratory and a botanical garden. His anatomical plates were very celebrated, and some of them were extant in the time of Haller. In 1620 he was made court physician to Christian IV. of Denmark, and removed to Copenhagen, where he died in 1638.

ARNO (the ancient ARNUS), a celebrated river of Italy. It rises in Monte Falterona, in the Apennines, descends into the valley of the Casentino, in Upper Tuscany, passes the town of Bibbiena into the plain of Arezzo, where it receives the Chiana as a tributary, and enters the narrow valley of Laterina.

ARNO, or AQUILA, tenth bishop and first archbishop of Salzburg, was one of those learned churchmen whom Charles the Great gathered round him, and who did so much to frame and strengthen the alliance between the Emperor and the Pope which lay at the basis of the Holy Roman empire of the West. The occasion of his introduction to the emperor was the defeat of Thassilo, duke of Bavaria, who had made war upon Charles, and

was compelled to sue for peace. He sent at the head of the embassy Arno, who was then bishop of Salzburg, and in whose talents and fidelity he had the utmost confidence. In 799 he presided at a synod of the church held at Reisbach, and in 807 at the more important synod of Salzburg. The zeal which he evinced for the conversion of the pagans of Hungary and Bohemia commended him to his ecclesiastical superiors. He established a library in Salzburg formed on the model of the emperor's palace library, and did all he could to further the interests of learning within his diocese. Assisted by a deacon named Benedict, he published a catalogue of the church lands, proprietary rights, and so on, belonging to the church in Bavaria.

ARNOBIUS, called Afer, and sometimes the Elder, was a native of Sicca Veneria in Numidia. The date of his birth is uncertain, but it must have been during the latter part of the 3d century of our era. He was a teacher of rhetoric, and at first an opponent of Christianity. His conversion is said by Jerome to have been occasioned by a dream; and the same writer adds that the bishop to whom Arnobius applied distrusted his professions, and asked some proof of them, and that the treatise *Adversus Gentes* was composed for this purpose. But this story seems rather improbable; for Arnobius speaks contemptuously of dreams, and besides, his work bears no traces of having been written in a short time, or of having been revised by a Christian bishop. From internal evidence the time of composition may be fixed at about 303 A.D. Nothing further is known of the life of Arnobius. He is said to have been the author of a work on rhetoric, which, however, has not come down to us. His great treatise, in seven books, *Adversus Gentes* (or *Nationes*), on account of which he takes rank as a Christian apologist, appears to have been occasioned by a desire to answer the complaint then brought against the Christians, that the prevalent calamities and disasters were due to their impiety, and had come upon men since the establishment of their religion.

ARNOBIUS, the younger, a Christian priest or bishop in Gaul, flourished about 460 A.D. He is the author of a mystical and allegorical commentary on the Psalms, first published by Erasmus in 1522, and by him attributed to the elder Arnobius. It has been frequently reprinted, and in the edition of De la Barre, 1580, is accompanied by some notes on the Gospels by the same author.

ARNOLD OF BRESCIA, remarkable as a forerunner of the Reformation and assailant of the Pope's temporal power, was born about the beginning of the 12th century, and became a priest in his native city. The fame of Abelard's eloquence induced him to repair to France for the sake of becoming his disciple. On his return he bitterly attacked the temporal dominion of the Pope and the wealth of the clergy, advocating the secularisation of all ecclesiastical property. He is said to have also impugned the current doctrine of the sacraments, but this appears to have been an invention of his adversaries. Persecuted in Italy, he returned (1140) to Abelard, and incurred the enmity of the latter's great antagonist, St. Bernard, whose denunciations drove him to seek refuge at Zurich, where he acquired great influence. A popular insurrection at Rome (1146) encouraged him to proceed to that city, where he appeared as a political agitator, preaching the deposition of the Pope and the restoration of the ancient republic. He became exceedingly popular, and aided in expelling the Pope from the city, but no practical effect appears to have been given to his plans. The Romans obtained, however, a free constitution on a different model. Upon their demanding the confirmation of this at the

accession of the new Pope, Adrian IV. (the Englishman, Nicholas Breakspear), it was refused unless upon condition of their delivering up Arnold. The demand being indignantly rejected, the city, for the first time in history, was laid under an interdict. The consequent suspension of all religious services so powerfully affected the people as to occasion a tumult, which compelled Arnold to take refuge in a castle in Campania (1155). A new emperor, Frederick Barbarossa, had meanwhile been elected, and was on the way to his coronation in Rome. By him Arnold was arrested and delivered up to the Pope, and the Roman constitution suppressed. Arnold was hanged, his body burned, and the ashes thrown into the Tiber. In history he ranks with Rienzi and Savonarola. His enemies have been his biographers, and they are unanimous in acknowledging his eloquence, his personal influence, and his perfect disinterestedness.

ARNOLD, SAMUEL, a distinguished English composer, was born at London in 1740. He received a thorough musical education at the Chapel Royal under Dr. Nares, and when little more than twenty years of age was appointed composer at Covent Garden Theatre. Here, in 1765, he produced his popular opera, *The Maid of the Mill*. In 1776 he transferred his services to the Haymarket Theatre. In 1783 he was made composer to George III., and ten years later, organist in Westminster Abbey, where, on his death in 1802, he was interred.

ARNOLD, THOMAS, a clergyman of the Church of England, was born at West Cowes, in the Isle of Wight, on the 13th of June 1795. In 1807 he was moved to Winchester, where he remained until 1811, having entered as a commoner, and afterwards become a scholar of the college. In after life he retained a lively feeling of interest in Winchester School, and remembered with admiration and profit the regulative tact of Dr. Goddard, and the preceptorial ability of Dr. Gabell, who were successively headmasters during his stay there.

From Winchester he removed to Oxford in 1811, where he became a scholar at Corpus Christi College; in 1815 he was elected Fellow of Oriel College; and there he continued to reside till 1819.

He left Oxford in 1819 and settled at Laleham, near Staines, where he was occupied chiefly in superintending the studies of seven or eight young men who were preparing for the university. His spare time was devoted to the prosecution of studies in philology and history, more particularly to the study of Thucydides, and of the new light which had been cast upon Roman history and upon historical method in general by the researches of Niebuhr.

After nine years spent at Laleham, he was induced to offer himself as a candidate for the head-mastership of Rugby, which had become vacant; and though he entered somewhat late upon the contest, and though none of the electors were personally known to him, he was nevertheless successful. He was elected in December 1827; in June 1828 he received priest's orders; in April and November of the same year he took his degrees of B.D. and D.D., and in August entered on his new office.

In one of the testimonials which accompanied his application to the trustees of Rugby, the writer stated it as his conviction, that "if Mr. Arnold were elected, he would change the face of education all through the public schools of England."

Rugby was privileged to enjoy his superintendence for nearly fourteen years.

In 1841 Dr. Arnold received from Lord Melbourne, then prime minister, the offer of the chair of modern history at Oxford, an offer which he accepted with

peculiar satisfaction. On the duties of this new office he entered on 2d December 1841, by delivering his inaugural lecture, amidst circumstances which he felt to be peculiarly gratifying and flattering. Seven other lectures were delivered during the first three weeks of the Lent term of 1842; the whole have been published since his death.

A few months after the delivery of his lectures, Arnold was suddenly removed from his earthly duties and anticipated enjoyments by an attack of angina pectoris. The midsummer vacation had arrived, and he was preparing to set out with his family to Fox How, a favorite retreat, where he had purchased some property and built a house, in Westmoreland. After a busy day spent in various duties, he retired to rest apparently in perfect health. Between five and six next morning he awoke in severe pain. All attempts to arrest the fatal malady proved fruitless. He bore with heroic fortitude and Christian resignation his sufferings, until eight o'clock, when he expired. The day on which he died was Sunday, the 12th of June 1842.

ARNOTT, NEIL, M.D., F.R.S., a distinguished physician and physicist, was born at Arbroath, 15th May 1788. In 1801 he entered Marischal college, where he took special interest in the natural philosophy subjects, taught at that time by Professor Copland, a skillful experimenter. There his natural bent to physical science was greatly strengthened. He studied medicine first at Aberdeen, and subsequently under Sir Everard Home, through whom he obtained, while yet in his nineteenth year, the appointment of full surgeon to an East Indian man. After making two voyages to China he settled in 1811 to practice in London, and speedily acquired high reputation in his profession. Within a few years he was made physician to the French and Spanish embassies. In 1836 he was appointed a member of the Senate of the new university of London, and became a fellow of the Royal and Geological Societies. In 1837 he was made a physician extraordinary to the Queen. From his earliest youth Arnott had an intense love of natural philosophy, constantly using illustrations and applications of its principles. To this liking was added an inventiveness which served him in good stead in his profession, and to which we owe the "Arnott water-bed," the "Arnott ventilator," the Arnott stove, &c., all of which, with characteristic philanthropy, he refrained from patenting. He was the author of several works bearing on physical science or its applications. He died in London, 2d March, 1874.

ARNOTTO, or ANNATTO, is a dyeing material produced from the seeds of *Bixa Orellana*, a small tree which grows in Central and South America. The seeds are surrounded with a thin coating of a waxy pulp, which is separated from them by washing in water, passing the liquid through a sieve, and allowing the suspended pulp to deposit. The water is then drained away and the paste dried, till it is a thick, stiff, unctuous mass. In this state it has a dark, orange-red color, and is known as "roll" or "flag" arnotto, according to the form in which it is put up, but when further dried it is called "cake" arnotto. Arnotto is much used by South American Indians for painting their bodies; among civilised communities its principal use is for coloring butter, cheese, and varnishes.

ARNSBERG, a city of Westphalia, in Prussia, the chief town of a government and circle of the same name. It is situated on an eminence almost surrounded by the River Ruhr, 44 miles S.E. of Munster, and 58 miles E.N.E. of Dusseldorf.

AROK-SZALLÁS, a privileged market-town in Hungary, on the Gyöngyös, 44 miles N.N.E. of Pesth, with a population of 10,400 largely engaged in the transit trade to Upper Hungary.

ARONA, a town in the province of Novara, near the southern extremity of Lago Maggiore.

ARPINO, a town on the River Garigliano (*Liris*), in the province of Caserta, in Italy, with a population of 10,000, engaged in the manufacture of woollen cloth, parchment, paper, &c.

ARQUA, a little Italian town, about 13 miles S.W. of Padua, with a population of 1100, chiefly known for that connection with Petrarch which has been so finely commemorated in Byron's lines—

"They keep his dust in Arqua, where he died."

ARQUES, a French village in the department of Seine-Inférieure, noteworthy for its castle, founded by William, the uncle of the Conqueror, which was the scene of several remarkable sieges, and gave name to the battle of 1589 in which Henry IV. of France defeated the duke of Mayenne and the Leaguers.

ARRACK, a name derived from the Arabic *arak* (perspiration), and applied to a spirituous liquor distilled in India, Ceylon, and Java, and generally consumed in Eastern countries. In Ceylon arrack is distilled from the fermented juice called toddy, drawn from the unexpanded flower-spates of various palms, chiefly the Palmyra palm and the cocoa palm. On the Indian continent a kind of arrack is made from the flowers of the Muohwa tree, besides that derived from palm toddy; and a large quantity of a nauseous and unpalatable spirit is distilled from rice, which goes by the name of rice arrack.

ARRAIGNMENT (from *arraigner*, to call to account), a law term, properly denoting the calling of a person to answer in form of law upon an indictment. After a true bill has been found against a prisoner by the grand jury, he is called by name to the bar, the indictment is read over to him, and he is asked whether he be guilty or not of the offence charged. This is the arraignment. His plea in answer to the charge is then entered, or a plea of not guilty is entered for him if he stands mute of malice and refuses to plead. If he pleads guilty sentence may be passed forthwith; if he pleads not guilty, he is then given in charge to a jury of twelve men to inquire into the truth of the indictment.

ARRAN, an island on the west coast of Scotland, near the mouth of the river Clyde, which forms part of the county of Bute. It is about 20 miles in length, by from 8 to 11 in breadth, and contains a superficial area of 165 square miles, or 105,814 acres, of which about 14,431 are cultivated. Game is abundant, consisting of blackcock and grouse. A few red deer and a number of wild goats still find shelter among the mountains.

The geology of the island is an epitome of that of Scotland. The mountains of the north, especially Goat-fell, consist of granite, surrounded on the flanks by micaceous and argillaceous slates; lying on the edges of the slate are well seen red sandstone and conglomerate, especially on the eastern shores, but easily traceable across the island. On the eastern side limestone, containing Carboniferous fossils, is found at several points intercalated among the red sandstones chiefly at Corrie, where several strata divided by shale are quarried. In the southern part of the island the stratified formations are overlain by a great series of trap-rocks. Several beds of coal were formerly worked on the northeast coast. This coal lies low down in the Carboniferous series, at the base of the Carboniferous limestone, or in the "calcareous sandstones." Numerous veins of most beautiful pitchstone and pitchstone-porphry traverse the red sandstone, especially at Drimadoun and between Brodick and Lamash. On the mountains are found jasper, agates, cairngorms, and smaller clear specimens of rock-crystal, called the Arran diamond.

ARRAS (the *Nemetacum* of the Romans), a fortified city of France, chief town of the department of Pas de Calais, and formerly capital of the province of Artois. Its name, otherwise Atrecht, is, like Artois, a corruption of the name of the Atrebatas. It is situated on both sides of the Scarpe, where the river receives the Crinchon, 32 miles N.E. of Amiens, and 100 miles N.N.E. of Paris. The town is well built and adorned with many handsome edifices, such as the town-house, a beautiful building, dating from 1510; the cathedral (1833), on the site of the older Gothic, which was destroyed in the Revolution; the citadel, erected by Vauban, who first employed his lunettes in the defences of the town; an arsenal, barracks, theatre, &c. It is the seat of a bishop, and of a court of assize; and has a royal society, a college, a diocesan seminary, an institution for the deaf and dumb, and schools of design and belles lettres, as well as a public library of upwards of 40,000 volumes, a picture gallery, museum, and botanical garden. Its chief manufactures are lace, woollens, hosiery, beet-root sugar, salt, soap, and earthenware; and there is a large general trade in wine, oil, grain, &c. It was at one time so celebrated for its tapestry that in English its name became identified with the manufacture. The River Scarpe is navigable up to the town. Population in 1872, 27,329.

Arras was the chief town of the *Atrebatas* as early as the time of Cæsar, and some remains of the Roman town, such as a temple of Jupiter, have been found. In 407 it was destroyed by the Vandals, and by the Normans in 880. It gives name to a treaty concluded in 1414 between the Armagnacs and Burgundians, to another between Philip the Good of Burgundy and Charles VII. of France in 1435, and to a third, in 1482, between Maximilian of Austria and Louis XI. of France, by which Burgundy and Artois were given to the Dauphin as a marriage portion. In 1493 it came again into the possession of Maximilian; and in 1578 it was held by the prince of Orange. In 1640 troops of Louis XIII. took Arras; and by the peace of Pyrenees, in 1659, France was confirmed in the possession of the town.

ARREST (from the French *arrest*, *arrêter*, to stop or stay) is the restraint of a man's person, for the purpose of compelling him to be obedient to the law, and is defined to be the execution of the command of some court of record or officer of justice. In the United States, except in rare instances, there is no arrest in civil cases. In criminal cases there are no persons privileged from arrest if the charge be felony. In misdemeanors, legislators, during the session of the legislature, are in most States exempt from arrest, as are also public officials while in the discharge of duty. In most States no arrest can be effected without a warrant, unless an officer of the law seize the criminal in *flagrante delicto*. A reasonable ground for suspicion will save an officer from action for false imprisonment.

The following is the English law on the subject:

I. In Civil Cases.—The arrest must be by virtue of a precept or order out of some court, and must be effected by corporal seizing or touching the defendant's body, or as directed by the writ, *capias et attachias*, take and catch hold of. And if the defendant make his escape it is a *rescous*, or rescue, and attachment may be had against him, and the bailiff may then justify the breaking open of the house in which he is, to carry him away.

The following persons are privileged from arrest, viz., 1st, Members of the Royal Family and the ordinary servants of the king or queen regnant, chaplains, lords of the bedchamber, &c. This privilege does not extend to servants of a queen consort or dowager. 2d, Peers of the realm, peeresses by birth, creation, or marriage,

Scotch and Irish peers and peeresses. 3d, Members of the House of Commons during the session of Parliament, and for a convenient time (forty days) before and after it. Members of Convocation appear to have the same privilege. 4th, Foreign ambassadors and their domestics and domestic servants." Temporary privilege from arrest is enjoyed by barristers traveling on circuit, by parties, witnesses, or attorneys connected with a cause, and by clergymen whilst performing divine service.

The arrest of any privileged person is irregular *ab initio*, and the party may be discharged on motion. The only exception is as to indictable crimes, such as "treason, felony, and breach of the peace."

Except in cases of treason, felony, or breach of the peace, an arrest cannot be made on a Sunday, and if made it is void; but it may be made in the night as well as in the day.

II. In Criminal Cases.—All persons whatsoever are, without distinction, equally liable to this arrest, and any man may arrest without warrant or precept, and outer doors may be broken open for that purpose. The arrest may be made,—1st, by warrant; 2d, by an officer without warrant; 3d, by a private person without warrant; or, 4th, by a hue and cry.

1. Warrants are ordinarily granted by justices of the peace on information or complaint in writing and upon oath, and they must be indorsed when it is intended they should be executed in another county (see 11 and 12 Vict. c. 42). They are also granted in cases of treason or other offence affecting the Government by the Privy Council, or one of the secretaries of state, and also by the chief or other justice of the court of Queen's bench in cases of felony, misdemeanor, or indictment found, or criminal information granted in that court. Every warrant ought to specify the offence charged, the authority under which the arrest is to be made, the person who is to execute it, and the person who is to be arrested.

2. The officers who may arrest without warrant are,—justices of the peace, for felony or breach of the peace committed in their presence; the sheriff and the coroner in their county, for felony; constables, for treason, felony, or breach of the peace committed in their view,—and within the metropolitan police district they have even larger powers; and watchmen from sunset to sunrise.

3. A private person is bound to arrest for a felony committed in his presence, under penalty of fine and imprisonment.

4. The arrest by hue and cry is where officers and private persons are concerned in pursuing felons, or such as have dangerously wounded others.

The remedy for a wrongful arrest is by an action for false imprisonment.

ARREST OF JUDGMENT is the assigning just reason why judgment should not pass, notwithstanding verdict given, either in civil or in criminal cases, and from intrinsic causes arising on the face of the record.

ARRESTMENT, in *Scottish Law*, denotes that process by which a creditor detains the goods or effects of his debtor in the hands of the third parties till the debt due to him shall be paid. It is divided into two kinds,—1st, Arrestment in security, used when proceedings are commencing, or in other circumstances where a claim may become, but is not yet, enforceable; and 2nd, Arrestment in execution, following on the decree of a court, or on a registered document, under a clause or statutory power of registration, according to the custom of Scotland. By the process of arrestment the property covered by it is merely retained in its place; to realise it for the satisfaction of the creditor's claim

a farther proceeding called "Forthcoming" is necessary. By old practice, alimentary funds, or those necessary for subsistence, were not liable to arrestment. By 33 and 34 Vict. c. 63, the wages of all laborers, farm-servants, manufacturers, artificers, and work-people, are not arrestable except (1) in so far as they exceed 20s. per week; but the expense of the arrestment is not to be charged against the debtor unless the sum recovered exceed the amount of the said expense; or (2) under decrees for alimentary allowances and payments, or for rates and taxes imposed by law.

ARRIA, the wife of Cæcina Pætus, who, having been engaged in the conspiracy of Scribonianus against the Emperor Claudius, 42 A.D., was condemned to death. Arria, resolving not to survive her husband, stabbed herself with a dagger, which she then handed to him with the words, "Pætus, it does not pain me." Her daughter, also called Arria, was the wife of Thrasea; and when he was condemned to death by Nero, she would have imitated her mother's example, but was dissuaded by her husband, who entreated her to live for the sake of their children. She was sent into banishment.

ARRIAN, a distinguished Greek historian and philosopher, who lived in the time of the Emperors Hadrian, Antoninus Pius, and Marcus Aurelius. He was a native of Nicomedia, born about the end of the 1st century of our era, and was one of the most distinguished disciples of the famous Epictetus. In 124 A.D. he lived at Athens, where he made the acquaintance of the Emperor Hadrian, who was so much struck with his practical wisdom as to raise him to several high offices; and under Antoninus he obtained even the consulship. The only other event of his life of which we know anything is, that he was appointed governor of Cappadocia, and in that capacity distinguished himself by the victory he gained over the Alani. Arrian proudly disdained to give any information regarding himself; and his life, written by Dion Cassius, is lost. History and philosophy are greatly indebted to Arrian; for, being a disciple of Epictetus, who himself did not write any work, Arrian determined to be to him what Xenophon had been to Socrates, and published his philosophical lectures in eight books, of which only the first half is extant; but the portion which has come down to us gives us a most exalted view of the ethical philosophy of Epictetus and the Stoics generally.

ARROWROOT. A large proportion of the edible starches obtained from the rhizomes or root-stocks of various plants are known in commerce under the name of arrowroot. Properly the name should be restricted to the starch yielded by two or three species of *Maranta*, the chief of which is *M. arundinacea*; and when genuine or West Indian arrowroot is spoken of, it is understood that this is the variety meant. *Maranta arundinacea* is originally a native of the American continent, but it has long been cultivated in the West Indian Islands, and it has now spread to most tropical countries. The plant produces a scaly, white, tuberous rhizome, and it is at the period when this organ is gorged with starch-cells, immediately before the season of rest, that it is ripe for use. In addition to about 25 percent. of starch, the fresh roots contain a proportion of woody tissue, vegetable albumen, and various salts. The arrowroot may be separated on a small scale in the same manner as potato-starch is frequently prepared, that is, by peeling the root and grating it in water, when the starch falls to the bottom. The liquor is then drained off, and the starch purified by repeated washings till it is ready for drying. On a large scale the manufacture of arrowroot is conducted with specially prepared machinery. The rhizomes when dug up are washed free of earthy im-

purities and afterwards skinned. "The fecula is subsequently dried in drying-houses. In order to obtain the fecula free from impurity, pure water must be used, and great care and attention paid in every step of the process. The skinning or peeling of the tubers must be performed with great nicety, as the cuticle contains a resinous matter which imparts color and a disagreeable flavor to the starch. German-silver palettes are used for skimming the deposited fecula, and shovels of the same metal for packing the dried fecula. The drying is effected in pans, covered with white gauze to exclude dust and insects."

Arrowroot is distinguished by the granules agglomerating into small balls, by slightly crepitating when rubbed between the fingers, and by yielding with boiling water a fine, transparent, inodorous, and pleasant-tasted jelly. In microscopic structure the granules present an ovoid form, marked with concentric lines very similar to potato-starch, but readily distinguished by having a "hilum" marking at the thick extremity of the granule, while in potato-starch the same appearance occurs at the thin end.

ARROWSMITH, the name of a family of geographers. The first of them, Aaron Arrowsmith, was born in 1750 at Winston in Durham. When about twenty years of age he came to London, and was employed by Cary, the engraver. In 1790 he made himself famous by his large chart of the world on Mercator's projection. Four years later he published another large map of the world on the globular projection, with a companion volume of explanation. The maps of North America and Scotland are the most celebrated of his many later productions. He died in 1823, leaving two sons, Aaron and Samuel, the elder of whom was the compiler of the *Eton Comparative Atlas*, of a Biblical atlas, and of various manuals of geography. John Arrowsmith, nephew of the elder Aaron, was born at Winstan in 1790, and in 1810 joined his uncle in London. In 1834 he published his *London Atlas*, the best set of maps then in existence. He followed up the atlas with a long series of elaborate and carefully-executed maps, those of Australia, America, Africa, and India being especially valuable. In 1862 he received the gold medal of the Royal Geographical Society, of which body he was one of the founders. He died 2d May 1873.

ARSACIDÆ, the dynasty of Parthian kings, so called from the name of the founder, Arsaces. Very little is known of the circumstances attending the sudden rise of the Parthian power, or of the leader under whom it was effected. He is said by some to have been a Parthian noble, by others to have been a predatory Scythian chief. But at all events, about 250 B.C., when the Seleucid empire of Antiochus II. was distracted by an Egyptian war and the successful rebellion of Bactria, the Parthians, hitherto subject and almost unknown to history, revolted, established an independent kingdom, and made their leader, Arsaces, their first sovereign. He is said to have been killed in battle, after a short reign of three years, and the throne was then occupied by his brother, Tiridates, who, like all succeeding sovereigns of Parthia, assumed the name Arsaces as a regal title. The empire increased rapidly in extent and strength, and for a time was the most formidable rival of the Roman power. Towards the close of the 2d century A.D. it had fallen somewhat into decay, as is manifest from the successful Roman invasions under Avidius Cassius and the Emperor Severus; and it finally succumbed to the Persians, who (224 A.D.) revolted under Artaxerxes, and slew in battle Artabanus, the twenty-ninth and last of the Arsacidæ. See PARTHIA.

ARSAMASS, a town in Russia, in the government of Nijni-Novgorod, at the confluence of two minor

tributaries of the Volga, the Arsha and Tesha. It has thirty-four churches, three monasteries, several schools, and various benevolent institutions. There are dye works, soap factories, iron works and extensive tanneries; and a large trade, stimulated by two annual fairs, is carried on, more especially in sheep-skins and sail cloth. The population is 10,517.

ARSENAL (supposed to be derived from *arx navalis*, whence the Romaunt word *arthenal*, signifying generally a "citadel," though primarily it meant simply a naval citadel), is an establishment for the construction, repair, receipt, storage, and issue of warlike stores.

In England the Royal Arsenal, Woolwich, manufactures and stores the requirements of the army and navy. Under the scheme of army localization now in force, there are district issuing stores for the troops for camp equipage, field stores, and reserve ammunition. The concentration of nearly all the English military factories and stores at one place, Woolwich, has long been considered an evil, and it has been proposed to establish, at some central spot, a large military dépôt or arsenal, which should be complementary to Woolwich.

The system of arms of the United States and their mode of manufacture is described at some length under "ARMS." In the war with Mexico, 1846-48, our arms were promptly repaired in the field by the use of spare parts, interchangeable, manufactured beforehand. This, at that time, differed from all other systems.

There were in 1860, upon the opening of the war of secession, twenty-three arsenals and armories. Nine of these were immediately enlarged and equipped as arsenals of construction. That at Springfield alone completed 1,000 muskets per day. In addition private workshops were employed, and twenty-five private armories were under charge of an officer whose duties were the superintendence of the work of arms contractors. The system employed in these contract shops was such that all pieces and parts were made precisely like those of the National Arsenal, and were interchangeable with them. A daily manufacture of about 1,000 muskets was obtained from these shops in addition to those made at Springfield. Their product also covered carbines, pistols, swords and equipments pertaining to them.

The Ordnance Bureau of the United States is generally considered a separate department of the military establishments, the quartermaster's department for general supplies and equipment, having nothing to do with its functions. Much attention has been devoted to the improvements in the manufacture of cast-iron guns of large calibre, and the name of Gen. Rodman is now well known in connection with a mode of cooling cast-iron cannon from the inside in manufacture. Gen. Rodman was first to suggest and manufacture what is known as *mammoth-grain powder* for use with large cannon.

One of the historic arsenals of the United States was that at Harper's Ferry, established about 1794, and used as a fort by John Brown in his raid into Virginia. Of the arsenals now in operation the chief is at Springfield, Mass., and in connection with it the armory for the manufacture of small arms. There are also in operation arsenals at Washington, Allegheny, Bridesburg, Pa. (Frankford Arsenal), for the manufacture of cartridges, caps, and primers for cannon, Fort Monroe, San Antonio, for repairs, Fort Leavenworth, Kas., depository and repairs, and the great establishment at Rock Island, Ill., which

is intended for future emergencies, and may be regarded as still under construction. It is equipped for an arsenal of construction, an armory, a foundry and a powder manufactory. Its situation is inland and peculiar, its grounds and buildings very extensive, and its tentative position of being ever ready and always waiting, a suggestive theme in a time of profound peace.

The earliest manufacture of war material by the United States was that of powder, in Virginia, in 1776. The arsenal at Springfield sent to the field its first supplies during that year. Small arms were manufactured by the United States before 1787. The war of 1812 was supplied from Springfield and Harper's Ferry. Previous to 1842 the arsenals had been under civil superintendence, but in that year they were placed in charge of officers, the "Ordnance Manual" was printed, there was a regular and obligatory, "System of Construction" adopted, with patterns, and the general precise system adopted which has since proved efficient.

Like most of the details of the French military organization, the arsenal system of that country is somewhat unsettled. It is understood that in future each territorial district of the army will have its own arsenal or, at least, its own dépôt of military stores; but while military factories are maintained, an amount of war material will also be drawn from private industry.

The chief German arsenals are at Spandau, Cologne, Dantzig. There are second class arsenals at Dresden, Ludwigsburg, Carlsruhe, Augsburg, Munich, in the confederate states, but the tendency is to reduce these; and a considerable concentration has taken place at Spandau, which now forms the great center of the military manufactories. Spandau embraces a gun and projectile foundry, powder factory, laboratory, small arms factory, and a large arsenal of construction. There are also a powder factory at Neisse, small arms factories at Erfurt and Dantzig, in addition to Krupp's great factory at Essen, in Westphalia. Artillery officers are largely employed in Germany in all the work of the arsenals.

At Vienna are united in one enormous arsenal a gun carriage factory, laboratory, foundry, small arms factory, etc. The arsenal can turn out 300,000 to 400,000 projectiles, 1,400 guns, 960 field carriages, and harness for 1,800 carriages.

Russia has made considerable strides in the improvement of her military manufactories within the last few years. She possesses small arms factories at Tonla near St. Petersburg, Sestroetz near Moscow, and at Ijewsk. There are foundries at St. Petersburg and Olonetz. The arsenal at St. Petersburg includes the foundry and other military establishments. The arsenals of Briansk and Kiev also contain military factories. Foundry establishments for furnishing projectiles and guns also exist at St. Petersburg, Alexandro-Olonetz (government of Olonetz), Longear (government of Ekaterinoslav), Perm, Ekaterinburg, Kamensk, Nijni-Isetsk, Werkhué-Tournisk, Barentschin, Glatonstov, etc. There are imperial powder factories at Ohta (near St. Petersburg), Schosta, and Kasan. There are also mobile artillery arsenals, the material of which is kept in time of peace at St. Petersburg, Warsaw, Kiev.

Italy has small arms factories at Brescia, Torre-Anunziata, near Naples, and Turin; powder factories at Fossano and Scafati. Turin is the center of the military factories.

Spain possesses an arsenal of construction at Seville, a factory at Toledo, a foundry at Trubia, and a small arms

factory at Oviedo. There are also the powder factories of Murcia and Grenada; the laboratory of Seville; and the factory of Orbaicete.

ARSENIC AND ITS COMPOUNDS. Although arsenic was not recognised as a metallic element till the 18th century, several of its compounds were known from remote antiquity; and the name *arsenicon* was applied by Dioscorides to the yellow sulphide of arsenic, orpiment, on account of its very potent properties. To the present day the term arsenic is more frequently applied to arsenious acid (the white arsenic of commerce) than to the metallic element to which it strictly applies. Although not very abundant, arsenic is one of the most widely disseminated of all metallic elements, few sulphur ores being free from traces of it. Metallic arsenic is found native in veins in metamorphic rocks in the mining districts of Saxony and Bohemia, and other European localities, at Zmeov in Siberia, and very abundantly in silver mines at Chanarcillo in Chili. The ores employed in the metallurgy of arsenic are mispickel or arsenical pyrites, smaltite, and cobaltite; the arsenic in the case of the last two being a bye-product of the preparation of cobalt and nickel.

Arsenic is a highly brittle metal of a steel-grey color, and of no very great importance in the arts. It may be prepared direct from arsenical pyrites by subliming in closed retorts, but it is more commonly reduced with powdered charcoal from arsenious acid. The physical characteristics of the metal vary according to the mode of its preparation; that produced directly from pyrites being compact, crystalline, and nearly white, while the metal reduced from arsenious acid is grey and pulverulent. It is chiefly used for mixing with lead in the manufacture of small shot, the alloy dropping in rounder form than pure lead, which produces tailed drops. Arsenic is added to iron and steel for the manufacture of chains and ornaments, the resulting combination taking a very brilliant polish; and an alloy of copper and arsenic produces a brittle grey metal of a brilliant silvery hue, used in the manufacture of buttons.

Arsenious acid, or more properly anhydride, the arsenic or white arsenic of commerce, is the form in which arsenic is chiefly produced in metallurgical operations.

White arsenic is one of the most violent of the acrid poisons. Its toxicological relations, the tests for it, &c., will be treated of under **MEDICAL JURISPRUDENCE**.

Arsenic acid is prepared from arsenious acid on the manufacturing scale by oxidising with strong nitric acid. It also is poisonous, but to a less degree than arsenious acid; and it is noticed that people employed about it become very fat, without any injury to health being apparent.

Two sulphur compounds of arsenic—realgar and orpiment—are also of industrial importance. Realgar, or ruby sulphur, is the disulphide of arsenic; and in its native form it was known to the ancients. It is prepared usually from arsenious acid by mixing and melting it with the required proportion of sulphur. It is used only to a limited extent as a pigment, and is a constituent of the Indian white fire used in fire signals and pyrotechny. Orpiment (*auripigmentum*), the yellow sulphide of arsenic, occurs native in many localities. It is, like realgar, artificially prepared by mixing arsenious acid with the requisite quantity of sulphur, and subliming the mixture.

ARSON has been defined as the malicious and wilful burning of the house of another, and is at common law an offence of the degree of felony. Some part of the house must be actually burnt; a bare intention or attempt will not constitute the offence, but the burning of any part, however trifling, is sufficient. The burn-

ing must be malicious and wilful. If a man by wilfully setting fire to his own house burn the house of his neighbor also, it will be felony. The word *house*, in the definition of the offence at common law, extends not only to dwelling-houses, "but to all out-houses which are parcel thereof, though not adjoining thereto." Barns, with corn and hay in them, though distant from a house, are within the definition.

ART, in the most extended and most popular sense of the word, means everything which we distinguish from Nature. Art and Nature are the two most comprehensive genera of which the human mind has formed the conception. Under the genus Nature, or the genus Art, we include all the phenomena of the universe. But as our conception of Nature is indeterminate and variable, so in some degree is our conception of Art. Nor does such ambiguity arise only because some modes of thought refer a greater number of the phenomena of the universe to the genus Nature, and others a greater number to the genus Art. It arises also because we do not strictly limit the one genus by the other. The range of the phenomena to which we point when we say Art, is never very exactly determined by the range of the other phenomena which at the same time we tacitly refer to the order of Nature. Everybody understands the general meaning of a phrase like Pope's "Blest with each grace of nature and of art." In such phrases we intend to designate familiarly as Nature all which exists independently of our study, forethought, and exertion—in other words, those phenomena in ourselves or the world which we do not originate but find; and we intend to designate familiarly as Art, all which we do not find but originate—or in other words, the phenomena which we do add by study, forethought, and exertion to those existing independently of us. But we do not use these designations consistently. Sometimes we draw an arbitrary line in the action of individuals and societies, and say, Here Nature ends and Art begins—such a law, such a practice, such an industry even is natural, and such an other is artificial; calling those natural which happen spontaneously and without much reflection, and the others artificial. But this line different observers draw at different places. Sometimes we adopt views which waive the distinction altogether. One such view is that wherein all phenomena are regarded as equally natural, and the idea of Nature is extended so as to include "all the powers existing in either the outer or the inner world, and everything which exists by means of those powers." In this view Art becomes a part of Nature.

ART AND PART, a term used in Scottish Law to denote the aiding or abetting in the perpetration of a crime,—the being an accessory before or at the perpetration of the crime. There is no such offence recognised in Scotland as that of being an accessory after the fact.

ARTA, a town of Albania, in the eyalet of Joannina, deriving its present designation from a corruption of the name of the river Arachthus on which it stands. It is a place of some six or seven thousand inhabitants, who are mostly Greek.

ARTA (*Arachthus*), a river of Albania, which rises partly in Mount Lakmon, and partly in the heights between Lingon and Mitzekeli, flows south for upwards of forty miles along the eastern side of the Kilberini Mountains, and falls into the Gulf of Arta.

ARTA, GULF OF, the *Sinus Ambracius* of the ancients, is a large and beautiful inlet of the Ionian sea, twenty-five miles long and ten broad, the northern shores of which belong to Turkey, and the southern and eastern to Greece.

ARTAXERXES, a royal Persian name, borne first

by several of the kings of the Achæmenian dynasty of the Persian empire, and found also in the later Sassanian dynasty. The original and native form of the name, as ascertained from the cuneiform inscriptions of ancient Persia, is *Artakshatra*. The Hebrew transcript, occurring with slight differences of spelling in different passages of the Old Testament, is *Artakshasta* — the Assyrian, *Sartakshatra* — the Scythic, *Iraksassa*, — all closely answering to the original. The Greek Artaxerxes from which the English form is taken, is less correct, and is misleading through the assimilation of the latter part of the name to the other royal name Xerxes, with which the word before us has etymologically no connection. In later times the name assumes the slightly modified forms of *Artakshetr* and *Ardeshir*.

It will be convenient first to mention the Achæmenian kings thus designated in the Greek historians and the old Persian inscriptions, and then consider the questions connected with the identification of these with the kings of this name occurring in Scripture.

1. Artaxerxes, surnamed Longimanus (by Persian authors, Diraz-dest), the long-handed, so called, says Plutarch, because his right hand was longer than his left, or perhaps the long-armed, was the son of the famous Xerxes, the invader of Greece, and succeeded his father in 465 B.C. According to Josephus he was originally called Cyrus. His reign was marked by the revolt of Egypt under Inarus, in which the Athenians were abettors of the Egyptians, and which was quelled by the Persian general Megabyzus, in 455 B.C.; and by the ratification of the peace of Callias with Athens in 449 B.C. Of the architectural and inscribed remains of the ancient Persian empire very little is recognizable as due to this king. He is recorded in an inscription by his grandson, the next Artaxerxes, as the *repairer* (?) of the palace at Susa. There is extant a fragmentary inscription in old Persian, with an Assyrian translation, which seems to have proceeded from him; and a legend upon a vase at Venice, of Egyptian origin, which reads "Artaxerxes the great king," may with considerable assurance be also referred to this monarch. Artaxerxes died in 425 B.C. after a reign of forty years.

2. The next sovereign that falls to be noticed here was the grandson of the preceding, and the son of the intermediate monarch, Darius Nothus. His original and private name was Arsaces, and he assumed that of Artaxerxes on ascending the throne. The date of his accession is 405 B.C. It is this Artaxerxes, commonly surnamed Mnemon, from the retentiveness of his memory, whose reign was distinguished by the attempt of his brother, the younger Cyrus, to gain possession of the crown, and by the victory of Cunaxa, 401 B.C., the death of Cyrus, and the retreat of the ten thousand Greeks, immortalized by Xenophon.

3. This sovereign was succeeded by his son Ochus, who, on securing the crown, took the same royal name, and is usually known as Artaxerxes Ochus. The commencement of his reign was marked by numerous formidable revolts throughout the western provinces of the empire, which, however, were vigorously repressed, and after the re-subjugation of the revolted countries, the power of the empire was advanced to an extent and to an apparent stability unequalled since the time of the great Darius. This Artaxerxes perished by poison in 338 B.C.

4. We find yet another instance in the classical writers of the use of Artaxerxes as a royal name during the Achæmenian period. After Darius Codomannus, the successor of Artaxerxes Ochus, had been finally and decisively defeated by Alexander at Arbela, he was, while fleeing before the conqueror, traitorously slain by Bessus, the satrap of Bactria, who thereupon, we are

told, "assumed the upright tiara and the royal robe, and the name Artaxerxes instead of Bessus, proclaiming himself king of Asia."

Such are the Achæmenian kings known to the classical writers by the name Artaxerxes. But the name also occurs in the Scriptural books of Ezra and Nehemiah, as well as in some of the Apocryphal books, and in Josephus; and it remains to be considered whether the persons there referred to are to be identified with any of the kings now mentioned, and if so, with whom? In the book of Nehemiah, Artaxerxes, king of Persia, appears as the monarch to whom Nehemiah acted as cup-bearer (i. 2), from whom he received a commission, in the twentieth year of the king, to rebuild the wall and other ruined edifices in Jerusalem (ii. 1), and whose thirty-second year is also mentioned (v. 14, xiii. 6). In attempting to identify this Artaxerxes with one of those above named, our choice is at once limited by the length of his reign to those surnamed Longimanus and Mnemon. A sufficient proof that it is the former of these who is meant, is found in the genealogy of Eliashib, the high priest when Nehemiah came to Jerusalem.

The name occurs again in an earlier part of the same book, chapter iv. In verse 5 of that chapter mention is made of efforts of the enemies of the Jews to hinder the rebuilding of the temple, put forth "all the days of Cyrus, king of Persia, even until the reign of Darius, king of Persia." Then in the two succeeding verses Ahasuerus and Artaxerxes are specified as kings in whose reigns representations adverse to the Jews were made at the court of Persia; and after the detailed accounts of the second of these representations, and its success with Artaxerxes, it is said (ver. 24), "Then ceased the work of the house of God which is at Jerusalem. So it ceased unto the second year of Darius, king of Persia." The narrative has all the appearance of consecutive history, and the natural interpretation obviously is that the two kings, Ahasuerus and Artaxerxes, intervened between Cyrus and Darius. It is true, mention is made in the memorial presented to king Artaxerxes of the building of the city and the walls, rather than of the temple, the rebuilding of which was at the time the great enterprise of the returned exiles; but this may be easily accounted for, from the interest of the writers to make out the strongest possible case at the Persian court. Besides, it is impossible to believe that the city and its walls remained utterly desolate as the Chaldeans had left them while the temple was being rebuilt. There is, indeed, express testimony to the contrary. Notice is taken of the "ceiled houses" of Jerusalem at this period (Haggai i. 4). Mention is also made of a "wall" of defence for its inhabitants (Ezra ix. 9), and Josephus (*Ant. Jud.*, xi. 4, 4) records the "strong walls about the city" while the temple was still unfinished. It has indeed been argued, and that quite reasonably, that the wall mentioned in Nehemiah i. 3, which was reported to Nehemiah as "broken down," is that to which reference is made in the passages just cited from Ezra and Josephus, built by the first colony of returned Jews, and not that destroyed by the Chaldeans nearly a century and a half before (see Kitto's *Cyclopædia*, article "Ahasuerus"). There seems, therefore, to be nothing in the narrative to hinder the two kings to whom it relates, and whom it places between Cyrus and Darius, from being identified with the two kings who did actually intervene between these monarchs, viz., Cambyses and the pseudo-Smerdis; and this is the view which is taken of the matter by the great majority of interpreters. The difference in the names, however, presents a difficulty which to not a few has appeared insuperable, and from which escape has been sought in various ways. Some, as Scaliger, Hot

tinger, Mill, believing that Ahasuerus and Artaxerxes in Ezra iv. 6, 7, means Xerxes and Artaxerxes Longimanus, suppose also that Darius in chapters iv. 24, vi. 1, &c., means the successor of the latter, viz., Darius Nothus. But the identification of the Darius with the well-known Darius Hystaspes is sustained by so overwhelming evidence (see DARIUS), that this opinion may be at once and without hesitation rejected. Others, as Howes (see *Pictorial Bible* on Ezra iv.), Biley (*Four. Sac. Literature*, July 1866), and many Germans,—as Kleinert, Schultz, Hengstenberg, Auberlen, Vaihinger, Bertheau, Keil, &c.,—believe that the paragraph, Ezra iv. 6-23, forms an interpolation or episode, in which the chronicler has summed up the attempts of the adversaries of Judah to hinder the building of the temple, as well as what they did for the obstructing of the building of the city under Xerxes and Artaxerxes, in order to bring together in a compendious way all their machinations against the Jews (see Keil, *ad loc.*). It is impossible, however, to reconcile this view satisfactorily with the language of the narrative, especially of ver. 24, the plain meaning of which is that the interruption in the work of the house of God caused by the decree of the king named Artaxerxes continued until, and hence was previous to, the second year of king Darius. Some German expositors, indeed, as Herzfeld (*Gesch. d. Volkes Isr.* i, 303), Merx, Schrader, &c., admit the irreconcilability, and, believing that the two kings in question were Xerxes and his son, maintain that the compiler of the book of Ezra was guilty of a mistake in referring the documents cited to the period preceding, instead to the period subsequent to, the reign of Darius. But, apart from all questions about inspiration, this must be condemned as an illegitimate procedure. Our only original witness to the events connected with the return of the Jewish exiles is the book of Ezra, and it is not permissible to alter its testimony, or to set it aside as erroneous, because it presents some appearances of discrepancy with what is otherwise ascertained. It is to be added that the Apocryphal 1st Esdras, in the version which it gives of the same events, refers them and the king Artaxerxes to the period intervening between Cyrus and Darius (Esdras ii. 16-30, v. 72, 73), and that Josephus also in so far agrees that he assigns the events to the same period, though making no mention of Artaxerxes, and naming Cambyses as the king by whom the work at Jerusalem was hindered (*Ant. Jud.*, xi. 2).

Retaining, therefore, the more common view, and identifying the Ahasuerus and Artaxerxes of Ezra iv. with Cambyses and the pseudo-Smerdis, it remains to be considered if the difference in the names presents any insuperable, or even any serious, objection. Confining the discussion to the subject of the present article (for the other name see AHASUERUS), it has been already abundantly evinced that Artaxerxes is a regal name, and was assumed by all who are certainly known to have borne it, in addition to their private and personal designation, on their accession to the regal power.

In the Sassanian dynasty there are three royal personages bearing the name now in question:—(1.) The founder of the dynasty is called Artaxerxes, or Ardeshir, surnamed Babegan, from the name of his father Babek. He was probably tributary king of Persia under the Parthian rule, and he revolted against Artabanus, king of Parthia, about 220 A.D. Artabanus was defeated and slain in a great battle in the plain of Hormuz, and Artaxerxes succeeded in establishing the ascendancy of Persia, and his own position as independent sovereign in 226 A.D. (see Malcolm, *op. cit.* i. p. 89; Rawlinson, *Sixth Oriental Monarchy*, p. 365, f.) (2.) Another Artaxerxes, belonging to the dynasty of the Sassanides, reigned for four years, 381-385 A.D. and (3) immedi-

ately before the Manometan conquest, an infant prince was raised to the throne by the same name, and nominally occupied it for five months, 629 A.D. For further details regarding these monarchs see PERSIA.

ARTEDI, PETER, an eminent naturalist, was born in the province of Angermania, in Sweden, on the 22d February 1705, and died the 27th September 1735.

ARTEMIDORUS, a native of Ephesus, flourished during the reign of Marcus Aurelius. He called himself The Daldian, from Daldia, or Daldis, a small town in Lydia, the birth-place of his mother, in order to distinguish himself from Artemidorus, the geographer, who was likewise a native of Ephesus. The work by which he is known, the Interpretation of Dreams, is said to have been written by command of Apollo Myses, who had granted to the author the power of divination.

ARTEMIS [DIANA], in *Greek Mythology*, twin sister of Apollo, but born a day before him, as it was said at Athens for the sake of explaining the fact of the 6th of each month being sacred to her, while the 7th was his day. It might seem, too, that their mother, Leto, had borne them in two different places, since the birth-place of Apollo was Delos, while that of his sister is called Ortygia. But the word Ortygia, meaning strictly, a "haunt of swallows," applies still to Delos, and may well have been a synonym for that island. Consistently with her relation to Apollo, she was conceived as sharing his aspect and attributes, her occupations and even her beauty tending rather to what would be appropriate for males. Both were endowed with perpetual youth, and this, if it did not originally help to suggest the idea of their being twins, is consistent with a universal feeling as regards that relationship. Like him she is armed with bow and arrows, which, jointly with him, she used against offending mortals as in the case of the Niobides, or of Laodamia, and the wife of Eëtion, she slaying women — he, men.

ARTEMISIA, daughter of Lygdamis, succeeded her husband in the kingdom of Halicarnassus, which was a dependency of the Persian empire. She took part in person in the expedition of Xerxes against the Greeks, and fitted out five ships, with which she distinguished herself in the sea-fight near Salamis, 480 B.C. When closely pursued by the Athenians she escaped by the stratagem of attacking one of the Persian vessels, whereupon the Athenians concluded that she was an ally, and gave up the pursuit. By her advice Xerxes did not attempt another battle, but at once retired from Greece.

ARTEMISIA, the sister and wife of Mausolus, king of Caria, immortalised herself by the honors which she paid to the memory of her husband. She built for him, in Halicarnassus, a very magnificent tomb, called the *Mausoleum*, which was one of the seven wonders of the world, and from which the name of Mausoleum was afterwards given to all tombs remarkable for their grandeur; but she died of regret and sorrow before it was finished. She died about 350 B.C.

ARTERIES (Gr. *arteria* probably from *air-ein*, to raise, but by some connected with *aer*, air, from the old idea that these tubes were air-carriers, since after death they are generally found empty), the vessels through which the blood passes from the heart to the tissues. The structure of an arterial tube is very complex, and a section of it may be roughly subdivided into three layers, called the coats of the artery: an external, consisting of interlacing bundles of fibrous tissue mixed with elastic fibres, which in large vessels such as the aorta are gathered together to form an elastic layer; a middle, which is muscular, contractile, and brittle, the fibres being arranged in a circular direction; an internal, also brittle, the free surface being smooth and formed of a single layer of endothelial cells. External to these cells

there is a layer of delicate connective tissue, outside which there is the elastic layer constituting the bulk of the inner coat, and distinguished by numerous perforations, causing its fenestrated appearance. The tube is also enveloped in cellular tissue, termed the *sheath* of the artery.

The arteries of the human body consist of two groups—those belonging to the lesser or pulmonic circulation, and those belonging to the greater or systemic circulation. All the offsets of the latter group are branches, more or less direct, of the aorta. As each main trunk passes into a portion of the body, it divides into two principal divisions: one, which breaks up into branches for the supply of the tissues in the vicinity—the artery of *supply*; and another, which passes almost branchless to supply the parts beyond—the artery of *transmission*. These, however, anastomose freely, so that the distant tissues are not solely dependent for their supply on only one arterial trunk, but may be supplied from several.

ARTERIOTOMY, or the opening of an artery, is an operation that has been strongly advocated in those cases in which it is desirable to produce a more decided and immediate depletion of the cerebral circulation (as in severe forms of sanguineous apoplexy) than could be produced by ordinary venesection. The only vessel operated on is either the temporal artery itself or one of its main branches, which is partially divided and allowed to bleed.

ARTESIAN WELLS, the name applied to water-springs rising above the surface of the ground by natural hydrostatic pressure, on boring a small hole down through a series of strata to a water-carrying bed enclosed between two impervious layers. In Europe this mode of well-boring was first practised in the French province of Artois, whence the name Artesian is derived. At Aire, in that province, there is a well from which the water has continued steadily to flow to a height of 11 feet above the ground for more than a century; and there is, within the old Carthusian convent at Lillers, another which dates from the 12th century, and which still flows. But unmistakable traces of much more ancient bored springs appear in Lombardy, in Asia Minor, in Persia, in China, in Egypt, in Algeria, and even in the great desert of Sahara.

In ordinary wells the water does not rise, but remains at the bottom of the trough dug for it in the soil, and to raise it we must use special apparatus or pumps. In Artesian wells, on the other hand, the water rises from a considerable depth to the surface of the ground, and usually spouts up to a greater or less height above it. The theoretical explanation of the phenomenon is easily understood.

The secondary and tertiary geological formations, such as those underneath London and Paris, often present the appearance of immense basins, the boundary or rim of the basin having been formed by an upheaval of the subjacent strata. In these formations it often happens that a porous stratum, consisting of sand, sandstone, chalk, or other calcareous matter, is included between two impermeable layers of clay, so as to form a flat porous U tube, continuous from side to side of the valley, the outcrop on the surrounding hills forming the mouth of the tube. The rain filtering down through the porous layer to the bottom of the basin forms there a subterranean pool, which with the liquid or semi-liquid column pressing upon it constitutes a sort of huge natural hydrostatic bellows. Sometimes the pressure on the superincumbent crust is so great as to cause an upheaval or disturbance of the valley, and there can be little doubt that many earthquakes, that are manifestly not of volcanic origin, are due to this simple cause.

It is obvious, then, that when a hole is bored down through the upper impermeable layer to the surface of the lake, the water will be forced up by the natural law of water seeking its level, to a height above the surface of the valley, greater or less according to the elevation of the level in the feeding column, thus forming a natural fountain on precisely the same principle as that of most artificial fountains, where the water supply comes from a considerable height above the jet.

ARTEVELDE, JACOB VAN, a celebrated Flemish popular leader in the 14th century, was a brewer in Ghent. His enormous wealth, great eloquence, and general talent for administration, easily made him the most prominent and powerful man on the side of the citizens in their struggle against the encroachments of Count Louis of Flanders. The people of Ghent gave him the command of their forces, and he banished from the town all the nobles and adherents of the count. In 1335 he made a commercial treaty with Edward III. of England, and with the aid of some English troops expelled Louis from Flanders. Ten years later, in 1345, after having persuaded Edward to assume the title of king of France, and induced the Flemings to support the claim, he thought to cement the alliance by making the Black Prince count of Flanders. This proposal was badly received by a large body of the people of Ghent, who were dissatisfied with their leader's somewhat arbitrary government. A popular tumult broke out with its usual impulsiveness, and Artevelde was slain.

ARTEVELDE, PHILIP VAN, son of the above, lived in retirement till 1381. Some years before that date enmity had again arisen between Count Louis of Flanders and the somewhat turbulent citizens of Ghent, who, under one Hyons, had expelled the count's adherents, plundered his house, and slain several of his officers. Hyons died in 1379, and in 1381 the citizens under Peter van der Bosch (Dubois), were closely blockaded by the count. In this emergency Van der Bosch proposed that the son of the great Artevelde should be invited to take the direction of affairs. Philip accepted, at once entered on public life, and by some strong measures secured his power. The inhabitants of Bruges had at this time allied themselves with the count, and Artevelde resolved to punish them. He led out his forces quietly, and utterly defeated the army of the count, who escaped with difficulty. Bruges was plundered and submitted to Artevelde. Next year the French, taking up the cause of Louis, invaded Flanders, and at Rosbecque completely routed the forces of Ghent. Many thousands were slain, and among them Artevelde himself.

ARTHROPODA. The Aristotelian distinction of *Malacostraca*, or Crustaceans, and *Entoma*, or Insects, has been referred to by Agassiz as in reality more precise than Linnaeus's last classification (1766), in which his Crustaceans form part of the Aptero group of insects. But whereas the Greek naturalist recognised the notchings which indicate annuli, *somites*, or body-rings, in *Coleoptera* and the other groups to which the class-name Insect, is now restricted, and in Worms, under which he comprehended insect larvæ, several true Annelids, and intestinal worms (*Scolecida*); he failed to appreciate this as a feature common to the *Malacostraca* or *Scleroderma*, which he named on account of the character of their integument. Linnaeus, on the other hand, saw that annulation was the most prominent common feature, and his *Insecta*, therefore, were a good natural group so long as embryology could throw no light on the affinities of the Cirripeds and parasitic Crustaceans—these two groups forming, together with the intestinal worms, molluscs, zoophytes, and lithophytes, the class *Vermes*. Cuvier (1829) includes in the third branch of his scheme, *Animalia articulata*,

Annelids, Crustaceans, Arachnids, and Insects (the Myriapods being an order of this class). Latreille (1796) proposed a scheme in which the orders of the Insects (as now restricted) formed equivalent groups with the Crustaceans, Arachnids, and Myriapods, which now first appear as a distinct group, though still united with a section of the Crustaceans. Latreille further, in 1801, recognized the Cirripeds as intermediate between his *Insecta* and the Molluscs. Lamarck gave the value of classes to the Insects, the Arachnids (including therein the *Thysanura* and *Myriapoda*), the Crustaceans, and the Cirripeds. But he has no province answering to the Cuvierian *Articulata*, since these orders are, with Annelids, Conchifers (= Lamellibranchs), and Molluscs (= *Odontophora*), members of the "sensitive animals," the Lernaean and other parasitic Crustaceans being an order of the *Vermes*, and therefore apathetic animals. De Blainville, still relying chiefly on external form, recognises four types in the sub-kingdom of the bilateral animal: — (*Artiomorpha* or *Artiozoaria*), of which the first is *Osteozoa* (Vertebrates). The second, *Entomozoaria* (Articulates), includes: Class 1. HEXAPODA, *Insecta proprie sic dicta*; 2. OCTOPODA, *Arachnida*; 3. DECAPODA, *Crustacea decapoda* and *Limulus*; 4. HETEROPODA, *Squilla*, *Entomostraca*, *Epizoa*; 5. TETRADECAPODA, *Amphipoda* and *Isopoda*; 6. MYRIPODA; 7. CHÆTOPODA, *Annelides*; 8. APODA, *Hirudo*, *Cestoidea*, *Ascaris*. The third type, *Malentozoaria*, is intermediate between the Articulates and Molluscs, and embraces two classes: *Nematopoda*, Cirripeds; and *Polyplaxiphora*, the Chitons. The classification of which this forms a part is a compromise between the method of Cuvier, based on the recognition of distinct plans, and that of Ehrenberg, who sketched each group as departing from the common plan of the animal kingdom only by excess of development in one or other direction. The *Articulata*, viz., *Insecta*, *Arachnoidea*, *Crustacea* (the Cirripeds and Epizoa being included), *Annullata*, and *Somatotoma* (the two latter making up all that are now known as Annelids), he distinguished from Molluscs by the isolation of their ganglia and their succession, those of the Molluscs being dispersed. Owen's *Homogangliata*, as equivalent to *Articulata*, is the expression of the same difference: his *Insecta* embrace two sub-orders, *Myriapoda* and *Hexapoda*, and the *Annullata* are placed between the Epizoa and Cirripeds. Milne-Edwards (1855) divides the *Entomozoaria* or *Annullata* into two groups, — (1.) *Arthropoda*, including Insects, Myriapods, Arachnids, and Crustaceans; and (2.) *Vermes*, including Annelids, Helminths, Turbellarians, Cestodes, and Rotifers. Siebold and Stannius (1845) made the Arthropods a primary division co-ordinate with *Vermes*, and united the Myriapods with the Crustaceans. Leuckart's *Arthropoda* comprise two classes, — *Crustacea* and *Insecta*; the latter combining the orders, *Myriapoda*, *Arachnida*, and *Hexapoda*. Fitzinger's *Arthrozoa*, or eminently motor animals, Crustaceans, Arachnoids, and Insects, contrast with the *Dermatozoa* or Molluscs, which are eminently sensitive. Von Baer's *Articulata* correspond to the Cuvierian group under the same designation, and like it represent a type of organisation, the longitudinal or bilaterally symmetrical, the organs being arranged with reference to the axial alimentary canal. The embryological system of Van Beneden (1855) rests upon the position of the vitellus relatively to the surface of the embryo, the Articulates being designated by him *Epicotyledones* or *Epiavitellians*, the vitellus being received into the embryo on the dorsal or upper surface, while the vertebrates receive the yolk on the ventral or lower surface, and are therefore *Hypocotyledones* or *Hypovittelians*. As will be

pointed out afterwards, this nomenclature is unfortunate, since the surfaces thus contrasted are identical, both being the hæmal aspects of the body. It may further be remarked that the term *Articulata* is manifestly one which should be abandoned, since it is made to represent very different things, being used by Cuvier, Ehrenberg, and Owen to include the Annelids, — by Van Beneden, Vogt, and some more recent writers, to their exclusion. Neither is *Arthrozoa*, the Greek equivalent of *Articulata*, more commendable. Burmeister and Fitzinger using it with the same difference. But *Arthropoda* has varied only in the rank assigned to it, not in the area it represents; thus Milne-Edwards makes it a sub-division of the *Annullata*; Van Beneden, Siebold and Stannius, and Leuckart, a primary division of the animal kingdom. But as a general designation for those animals which are made up of nearly equivalent somatomes or somites is needed, Macleay's term *Annullosa* is, perhaps, the best, since it has never been used for two incommensurate groups. Leach, and later (1825) Latreille, proposed *Condylapoda* as the name of the group for which *Arthropoda* was afterwards devised. Custom has overborne the rule of priority, and the latter is now the more common name. The classifications hitherto mentioned rest solely on an anatomical basis, those of Von Baer and Van Beneden dealing only with the observed facts of development. Haeckel, applying all that was known of embryology to the construction of the pedigree of the groups, made (1866) the *Articulata* one of the five great trunks of the genealogical tree. The Articulate phylum embraced the Infusoria and intestinal worms, as well as the Annelids, along with the *Arthropoda* as restricted above. The *Arthropoda* further formed two groups: — *Carides*, the branchiate Arthropods or Crustaceans; and *Tracheata*, the Arachnids, Myriapods, and Insects, which breathe by tracheæ. The term Articulate disappears from Haeckel's latest classification, in which a redistribution of the phyla is set forth. From assumed ancestors destitute of body-cavity (*Acalomi*) descend those *Vermes* with body-cavity, of whose plan *Echinodermata*, *Arthropoda*, *Mollusca*, and *Vertebrata* show special modifications. In 1870 Gegenbaur gave a general table, in which the *Vermes* included *Tunicata* and *Annullata*. The former led towards the *Mollusca*; the latter was the starting point of *Arthropoda*, *Vertebrata*, and *Echinodermata*; of the Arthropods there are four classes, — Crustaceans, Arachnids, Myriapods, and Insects. Amidst all the varying opinions as to the value of the group, the importance of the limb-structure has been recognised since Latreille dwelt upon the articulations by which the parts of these appendages are connected.

The *Arthropoda* agree in the characteristic already mentioned, the articulations of their limbs, whence the class-name is derived. The body presents various degrees of complexity. In the caterpillar, the *metamera*, *somites*, *somatomes*, or *annuli*, owe their mobility to differences in thickness of the integument. In the Myriapods the numerous similar somites are flexed on each other by the overlap of the chitin-thickened portions of cuticle which protect the upper and lower surface of each division. The somites are more or less effaced in the abdomen of insects and spiders; head and thorax in crabs and spiders have their composite origin concealed. But the external signs of division of the body no longer correspond, as in Annelids, to the distribution of the internal organs, which, with a partial exception in the case of the nervous system, are now unities contributing to the well-being of the whole. Homonymy, the absence of segmentation, or the equivalence of the divisions of the body, among the Annelids, has been contrasted with the heter-

onomy, or segmentation of the arthropod body. The difference, however, is only one of degree, since both the cephalic and caudal extremities, at least of the higher Annelids, are true segments, *i. e.*, fused somites which, in addition to fusion, have undergone some amount of specialisation. In the four classes of Arthropods the head is a constant segment. It consists of præ-oral and post-oral somites, the ganglia of which are represented by the supra- and sub-oesophageal masses. The number of somites, as represented by appendages, is not the same in the four classes, and as the variation affects the præ-oral appendages supplied from the supra-oesophageal ganglion the difference is of great importance.

ARTHUR, or ARTUS, a hero of the Welsh Tales, the Chronicles of Geoffrey of Monmouth, and the Romances of the Round Table. His exploits, even the most fabulous, passed with historians, before the days of historical criticism; subsequently a reaction led to the figure of Arthur being regarded as nothing but a Celtic myth. The truth, so far as it is possible to arrive at it, lies between these two extremes. There was a real Arthur, one of the last Celtic chiefs in Great Britain; but there is no single trait of his real character and exploits which legends, working according to laws to be presently discussed, have not remodelled and transfigured or disfigured; while the scarcity of documents makes it impossible to construct a coherent historical picture. Thus the work of comparison between the historical and the legendary personages, such as has been performed for Charlemagne by MM. Gaston Paris and Léon Gautier, is impossible in the case of Arthur. We can only study the legend and analyse its elements.

There is an error, not so popular as it once was, which supposes that myths and legends are arbitrary creations, and does not recognise them as having an origin in regular causes, and therefore a rational history, before the period when they are crystallised into their final legendary form, or are merged in the current of a literature in that later and artificial stage when it disinters and refashions old materials. Before Arthur took his final French form in the Romances of the Round Table, he was a Celtic hero in the Breton, and more specially still in the yet earlier Welsh, legends. And behind these is the original Arthur, of whom we must be content with such impressions as we can gather from his contemporaries, Myrddhin and Llywarch.

Llywarch, a bard and king, born about 480, was one of the companions of the valiant chief, Urien of Reghed, in Cumberland, upon whose death he composed a pathetic lament. He survived the death of his twenty-four sons in the last struggles against the Saxon, and in his old age, banished and a cripple, he wrote from his hiding-place a mournful hymn on his own and his country's decay, in which the lovers of the poetry of despair have admired this verse worthy of Job:—"See yonder leaf driven by the wind; woe for him who has the like lot! it is old, though born within the year." But the bard-king had only despaired after a life-long struggle, and in like manner the bard-prophet Myrddhin had long sung in praise of peace before he went mad with grief, on the night of the battle of Arderidd, where the northern and southern Celts slaughtered each other to the profit of the Saxons. Before this fratricidal struggle (the beginning of the 6th century) Myrddhin had cherished the dream of the resurrection of an ancient chief, whom he called Llemeniz.

By this chief of heroes, destined to bring back union, the bard meant his king and friend, Aurelianus Ambrosius, and after his death Arthur, his valiant successor, and Myrddhin's own pupil. The battle of Arderidd came to dissipate the last of these illusions. One of

the contending hosts consisted of northern Celts, bent upon imposing on all their race yet unconquered in Great Britain the authority of Howell of Scotland, the brother of that Gildas who soon afterwards became a convert at once to Christianity and to Saxon interests. The other host, that of the southern Celts, was led by Aurelianus Ambrosius, whose favorite bard was Myrddhin. After the final destruction of the Celtic power, the destiny of Myrddhin is to reappear in legend with the Latinised name of Merlin. Aurelianus Ambrosius and Arthur, the two Celtic chiefs to whom the bard had been so loyal, undergo a like resurrection; but their lives and exploits are confounded, according to the accumulative method of legend, with each other and with those of Vortigern, king of Kent. The Arthur of the legend more than realises all the prophecies of Merlin; and these prophecies in the process of oral repetition, and in travelling further from the place and the time of their origin, themselves were altered to an ampler tenor. They underwent one great degree of change in crossing the Channel, and another and greater in passing from the soil and speech of Brittany into those of France. With the tenor of the prophecies grow the proportions of the hero. The poetic Arthur pacifies the Celts, quells the Saxons, and ends by establishing a reign of justice upon earth. It is a hard saying, but true, that the key to all this is a certain sentiment which is the mark of conquered races. The Celtic genius after its defeat in arms would have revenge in songs. What happened was this. The Celtic chief, Vortigern, summoned to his help the Saxon chief Hengist. Now, let it be noted that, in the annals of the Saxon kingdom of Kent, the fourth king in succession from Hengist is the Saxon Ethelbert. Turning to the legend, it will be found that the corresponding fourth king in succession from Vortigern is the British Arthur. For in legend the treachery of Vortigern must not be allowed to bear fruit, the Celts after many a struggle must be left conquerors. The honor of giving the last blow to the Saxon invasion in Kent, West Wales, and elsewhere, is assigned in the legend to Arthur. And why to Arthur? Because of the ancient prophecies of the resurrection of the fabled Llemeniz, with whom later times identified him, and above all, because the whole legendary structure hinged upon the impressive portraiture of Merlin, whose historical prototype had, in fact, been the devoted follower of the historical Arthur and Aurelianus Ambrosius. But this edifice of fable, under which the Celts strove to hide from themselves the real ruin of their race, was not built up in a day. The conquered people repeated and enlarged upon the prophecies of Merlin; and with these grew the figure of Arthur, enriched by every noble trait which could be borrowed from the stories of the bravest chiefs, and made to accord with the prophecies. Round the main personage soon revolved other ideal types, and little by little was founded the harmonious hierarchy of King Arthur and his knights, such as it now remains in romance, and such as never existed in reality.

ARTICHOKE. The common artichoke, *Cynara Scolymus*, is a plant belonging to the Natural Order *Compositæ*, having some resemblance to a large thistle. It has long been esteemed as a culinary vegetable; the parts chiefly employed being the immature receptacle or floret disk, with the lower part of the surrounding leaf-scales, which are known as "artichoke bottoms." In Italy the receptacles, dried, are largely used in soups; those of the cultivated plant as *Carciofo domestico*, and of the wild variety as *Carciofo spinoso*. The Jerusalem artichoke, *Helianthus tuberosus*, is a distinct plant belonging to the same order, cultivated for its root-tubers, which somewhat resemble potatoes, for which

they have been proposed as a substitute. It closely resembles the sunflower, and its popular name is a corruption of the Italian *Girasole Artico*; the sunflower artichoke.

ARTICLES, THE THIRTY-NINE, of the Church of England, contain the public standard of religious belief adopted by that body. They were drawn up by Archbishop Parker, sanctioned by Convocation in 1562, and published by royal authority in the following year. The general principles of this body of doctrine, and the form into which it was thrown, had been gradually developed during the previous attempts to establish a standard of faith in England. Soon after the authority of the Pope had been thrown off by the English Church, there began to appear wide differences of opinion with regard to the extent of reformation required. One party, the conservative, held by the old practices of the Church of Rome; another, the moderate reformers desired to abolish these practices on account of the abuses to which they were liable; while the various sects of the Anabaptists were eager for radical reformation both of doctrine and of practice. Religious turbulence and strife prevailed to such an extent that, in 1536, a set of TEN ARTICLES was published by royal authority, intended, as was expressly stated, to "stabylsye Christen quietnes and unitie among us, and to avoid contentious opinions." A considerable share in the composition of this code was taken by Henry himself. The articles were evidently intended as a compromise; they contained much that was afterwards rejected by the church, and do not seem to have given general satisfaction. They were partially, through not authoritatively, superseded by the publication, in 1537, of the *Institution of a Christian Man*. For two or three years before this negotiations had been carried on with the Continental reformers, and proposals had been made for a general conference at which some universal articles of faith might be considered. The conference took place but did not attain the end desired, for Henry, at first favorably disposed, was swayed by the influence of the anti-reformation party; and Cranmer, while able to come to agreement with the German deputation so far as points of doctrine were concerned, saw clearly that it would be a hopeless task to try to abolish all the ancient ceremonies. The increasing influence of the conservative party led to the passing, by Convocation and Parliament, in 1539, of Henry's SIX ARTICLES, the "bloody statute," or "whip with six strings," as they were then called, from the cruel persecutions to which they gave rise. These articles enforced belief in transubstantiation, declared that communion in both kinds was unnecessary, that the marriage of priests was unlawful, that vows of chastity or widowhood were absolutely binding, that private masses and auricular confession were expedient and necessary. The severity of these doctrines was mitigated by the third authorised formulary of Henry's reign, *The Necessary Doctrine and Erudition for any Christian Man*, called the "King's Book," and published in 1543. The conference with the Germans, though not entirely successful, had not been without fruit. Among Cranmer's papers has been found a set of Thirteen Articles bearing evident traces of the Continental ideas, and highly interesting on account of the influence it exercised on the later formularies. Many of these articles are drawn directly from the Augsburg Confession, and there seems no doubt that they thus formed an intermediate step between that Confession and the FORTY-TWO ARTICLES of Edward. Great care was taken in their preparation; the first draft was sent round to the bishops, then revised by Cranmer, submitted to Cheke and Cecil, and to the six royal chaplains, and finally laid before the council. In 1553

the mandate enjoining subscription to them was granted by the king, but the articles had already been printed in English.

During the reign of Mary these articles were suppressed, but, on the accession of Elizabeth and the elevation of Parker to the see of Canterbury, attention was again directed to the framing of some standard body of truth. A series of Eleven Articles was drawn up in 1559, and was in use for some time; it had not, however, full authority, though it was enforced in Ireland until 1615. In 1562 the houses of Convocation were summoned, and Parker laid before them a revised copy of the Forty-Two Articles. The changes introduced by them were, for the most part, Lutheran in tendency, and were probably influenced by the Württemberg Confession of 1551. The articles, now thirty-nine in number, were submitted to the queen, who is said to have read and examined them.

The articles are not intended to be a complete system of theology, but only enumerate certain truths of such primary importance that any one denying them is thereby excluded from the church.

ARTICLES OF WAR, ordinances for the government of troops, seamen and camp-followers, by punishing as crimes, acts or omissions which in civil life would be mere breaches of contract—*e. g.*, desertion or disobedience of orders. The United States Articles of War are published in the annual Army Regulations, and cover generally the same ground as those of England. Sentences of death by courts-martial must be concurred in by at least two-thirds of the members, and with few exceptions, must be confirmed, before execution, by the President. In this country marines are subject to the regulations for the army or navy, according as they happen to be engaged with either branch of the service; the Naval Articles being, however, essentially the same as those governing the army.

ARTICULATA, the name given by Cuvier to his third great division of the animal kingdom. *Arthropoda* is the designation now generally adopted, which includes the *Crustacea*, *Arachnida*, *Myriapoda*, and *Insecta*, but excludes the *Annelida*, which Cuvier classed with these among the *Articulata*. See ARTHROPODA.

ARTIFICIAL LIMBS are mechanical contrivances adapted to reproduce the form, and as far as may be, the function of a lost or absent member. They have, in one form or other, been in use from very early times. Herodotus mentions the case of a prisoner who amputated his own foot to escape from his shackles, and, escaping to his friends, was provided with a wooden substitute.

The celebrated artificial hand of the German knight, Götz von Berlichingen—"Götz of the Iron Hand"—was invented about 1504 by a mechanic of Nuremberg. It weighed three pounds, and was so constructed as to grasp a sword or lance.

The utility of an artificial arm depends much on the nature of the stump. The simplest form of artificial arm after amputation above the elbow, consists of a leathern sheath accurately fitted to the upper part of the stump. The lower end of the sheath is furnished with a wooden block and metal screw-plate, to which can be attached a fork for holding meat, a knife for cutting food, or a hook for carrying a weight. The arm should be so carried as to represent the position of the natural arm when at rest. It is retained in its position by shoulder and breast straps, and forms a light, useful and inexpensive substitute for the lost member.

The Beaufort arm possesses an instinctive power of movement. It consists of a wooden hand attached to a leathern socket that firmly fits the stump. The fingers are half closed, parallel to one another, the first two finger-tips opposing that of the movable thumb. The

thumb is pivoted on a pin concealed in the ball of the thumb; it is firmly pressed against the fingertips by a strong india rubber band similarly concealed. A piece of whiplard is attached to the back of the thumb, whence it runs upward to the shoulder of the wearer, and across his back to the opposite shoulder, around which it is fastened by a tape loop. By drawing upon and relaxing the whiplard, the grasp of the thumb is alternately opened and closed; and these movements can be attained by slight movements of the shoulders, or by advancing and retracting the artificial arm.

The simplest artificial leg is the "bucket" leg, consisting of a hollow wooden or leathern sheath, fitting accurately to the contour of the stump, and having a "peg" firmly attached to its lower end. The weight is here chiefly borne by the "sitting bone," which reposes on the smooth brim of the "bucket." The end of the stump should not quite reach the floor of the "bucket;" hence it takes no part in supporting the weight of the body, which might give rise to pain in the stump. This appliance is suited only for amputation through the thigh. Its great defects are the absence of bending at the knee, and the absence of a foot, which makes it useless on soft ground.

The Beaufort leg, invented by the Count de Beaufort in 1851, and improved subsequently, has three great recommendations; it lengthens the stride that can be safely taken, it reproduces the natural gait, and it is remarkably cheap. Baron Larrey, the celebrated French surgeon, reported on this invention to the Academy of Medicine, that "it consists of a piece of ash-wood, which, like the peg, is attached to the ordinary wooden leg. It replaces the metal disc of the peg, and is shaped somewhat like a foot, but shorter in length. The plantar surface is covered with a leathern sole, garnished with cork at the heel. It is curved in form, the curve being such as to give the limb continuous lines of bearing on the ground while the body moves forward, save that the curve is not so perfectly uniform as to involve any danger of slipping."

ARTILLERY. The modern term *Artillery* is used in two senses,—firstly, to designate the *material* of artillery; *i. e.*, the guns, etc.; secondly, the *personnel* and organization by which the power of this arm is wielded. The word itself is derived by some from "arcus," a bow; by others from "ars telaria," signifying bows, arrows, and all implements of projectile warfare.

The history of artillery proper may be said to date from the discovery of gunpowder. This is popularly attributed to the two monks, Roger Bacon and Bartholdus Schiraz, about the end of the 13th century (see GUNPOWDER); but there is ample evidence that a substance of somewhat similar composition and powers had been known and used for purposes of war in the East at far earlier times. The Chinese seem to have been the first discoverers of explosive compounds as engines of war, and to have used them for several centuries before the Christian era; and their "thunder of the earth," produced by filling a huge bombshell with some such compound, and exploding it at the proper moment, is spoken of as early as the 3d or 4th centuries of our era. According to Father Amyot, stone mortars, projecting stone balls, were used by them in the 8th century; and although they were first instructed in the scientific casting of cannon by missionaries in the 17th century, there is evidence of large cannon and wall pieces of rough construction having been in use as early as the

12th century. The inhabitants of India seem to have possessed firearms of some sort as early as the time of Alexander; but the information is too meager to admit of more than the merest speculation as to their nature. The celebrated Greek fire, of which we have ample accounts, was usually in a liquid form, and vomited through long copper tubes, with which the bows of vessels of war were provided, or projected in fire balls, or by means of arrows and javelins around which flax was twisted. It was used by the Romans of the Eastern empire with much effect, especially with the defenses of Constantinople (668-675 and 716-718 A. D.), and the secret of its manufacture was preserved with a superstitious care for more than 400 years; but it afterwards passed into the hands of the Mahometans, and was used by them in their wars with the Christians. The Moors first introduced firearms in western Europe; according to Condé, they used artillery against Saragossa in 1118 A. D., and a little later they defended Niebla by machines which threw darts and stones by the agency of fire.

The application of gunpowder to projectile warfare, and the use of cannon, became general in Europe during the 14th century. Mention is made, however, of isolated instances of their employment at earlier periods, especially among the Moors. Artillery is also said to have been used by Henry III. of England during the rebellion of the Duke of Gloucester in 1267, and by the Spaniards against Cordova in 1280 and against Gibraltar in 1306. But it is held by those well qualified to judge, that the first unquestionable testimony of the employment of cannon is in 1338 under Edward III. of England. The substitution of the new engine for the old mechanical artillery was gradual, and was not effected without opposition; and in the 13th and early part of the 14th centuries, are still found various machines, such as the trebuchet, onager, scorpion, and espringal, whose action was dependent on the elasticity of twisted cords, used to hurl stones, Greek fire, etc.

The earliest trace of an artillery organization, such as now plays so important a part in all great armies, is found in the middle of the 14th century. In 1344 Edward III. formed an artillery train and an ordnance establishment, numbering 340 men; but of these only twelve were termed artillerymen and gunners, the remainder consisting of wagoners, engineers, and artificers of various kinds.

The guns of the 14th century were of the rudest make, cumbrous and inefficient, and though an advance on the earlier machines, and useful in sieges, still played but little part in battles. Whether Edward III. used them at Créci or not (a point which has been much debated), it may safely be affirmed that they had but little to do with the result of that day.

Progress, however, began to show itself in the 15th century; the "bombards" were replaced by brass guns, and the cumbrous beds, upon which the earlier ordnance were transported, gave way to rude artillery carriages on wheels; and iron was substituted for stone in the manufacture of projectiles. The first step towards a better organization and some tactical system appears to have been made towards the end of the 15th century by Charles VIII. of France, who used a numerous artillery in his Italian campaigns; and Louis XII. largely owed his successes in Italy to this arm.

The 16th century was not marked by any great advance in artillery science, though the number of guns which accompanied an army had increased considerably—as many as 1,600 gunners, cannoneers, armorers, and clerks of the ordnance, being attached to Lord Mountjoy's army in Ireland in 1599.

In England but little advance was made even in the 17th century, and the commencement of the Great Rebellion found the artillery of England in a very feeble and backward state. Two books by artillerymen of those days give us much information on its condition, and a very complete account of the "Field Artillery of the Great Rebellion" is furnished by Captain H. W. L. Hime, R. A. The transport of the ammunition was in carts or wheelbarrows, or on men's backs. The gunners walked beside the gun, and, as in later times, their pace was a measure of the mobility of the field artillery. Cartridges, when used, were made of paper or canvas, but an iron ladle was preferred.

As to the draught, twenty-three horses were required for a cannon on good ground, fifteen or seventeen for the demi-cannon, and nine for a culverin. The proportion of guns to men was 1 per 1,000.

The first half of this century forms an era in the history of this arm in Europe. Henry IV. of France was among the first to recognize its coming importance, and occupied himself diligently with improving it. His minister, Sully, was named master general, and during the last ten years of his reign (1600-1610), he may be said to have created an artillery. But it was under the great Swedish warrior Gustavus Adolphus that artillery first began to take its true position on the battle-field. Recognizing the necessity for the mobility of field artillery, he introduced "*Kalter*" guns, "consisting of a thin cylinder of beaten copper screwed into a brass breech, whose chamber was strengthened by four bands of iron, the tube itself being covered with layers of mastic, over which cords were rolled firmly round its whole length and equalized by a layer of plaster, a coating of leather, boiled and varnished, completing the piece." This primitive field artillery was drawn and served by two men, and was first used in his Polish war. The guns could naturally bear but a small charge though the first specimens of the "built-up" gun. Rapidity of fire was obtained by the use of cartridges instead of the old method of lading the powder. Gustavus attached two of these guns to each regiment, and placed them under the orders of the colonel. Gustavus Adolphus may therefore be said to be the father of the battalion system of guns. It was in the celebrated Thirty Years' War that his artillery showed the advantages which it could win when handled properly. The artillery of the Imperialists was as cumbrous as that of their Swedish adversaries was mobile. Tilly's guns were chiefly 24-pounders, each requiring twenty transport horses and twelve horses for the wagons, while the service of guns was primitive and defective, and they could hardly even be moved during the course of an action. At the battle of Lützen, Nov. 6, 1632, Wallenstein had taken advantage of certain eminences and rising ground in his position to post his guns in batteries of from four to fourteen pieces, while Gustavus placed powerful batteries on the wings and center of his line. The battle closed the glorious career of this great warrior, who was struck down in the hour of victory.

In England the laboratory at Woolwich was established in 1672, and a great reorganization of the artillery took place in 1682 under the master general, Lord Dartmouth. In France the improvements under Louis XIV. seem to have been made chiefly in siege artillery. Heavy guns of position were much used, and there appears to have been a disposition to regard batteries of this kind, covered by epaulments, as in field fortifications, as the natural rôle of artillery.

The 18th century was fruitful in artillery progress.

In England it saw the Royal Regiment of Artillery permanently established, and rapid strides made on the Continent in every branch of the arm. About this period (the middle of 18th century) the guns in use consisted of 24-pounders, 12-pounders, 6-pounders, and 3-pounders. The guns were divided into brigades, corresponding to the present batteries, of four, five, and six guns respectively, and began to be separated into "heavy" and "light" brigades. Each field gun was drawn by four horses, the two leaders being ridden by artillerymen, and had one hundred rounds of shot and thirty rounds of grape.

The Prussian artillery was very backward at the beginning of this century. In 1688 the Brandenburg (Prussian) artillery numbered only three hundred men; and at the death of Frederick-William I., in 1740, there was only one battalion of field artillery of six companies, and one of garrison artillery of four companies. Nor did Frederick the Great at first place much value upon its services. But experience soon convinced him of the necessity for creating an efficient and mobile field artillery. His wars brought forward three important tactical principles in the employment of artillery,—the establishment of smaller batteries at important points in the line of battle in lieu of the old formations at the center and flanks, opening the battle and protecting the deployment of columns by light guns, and changing the position of batteries according to the course of the action.

Russia and Austria, though they produced no great military leader like Frederick, were ahead of Prussia in the development of this particular arm.

In Austria, though the tactical employment of the artillery was often defective, its general excellence was pre-eminent, and it was ably organized under Prince Lichtenstein, the chief of artillery. But it was in France that the experience of Frederick's wars was best utilized, and the great strides to a more perfect system were made.

At the commencement of the century French artillery had made but little progress. The carriages and wagons were driven by wagoners on foot, and on the field of battle the guns were dragged about by ropes or remained stationary. Hollow projectiles had made their appearance, and lead tarred balls arranged around an axis and kept together by a net, and termed *grape*, were employed. But the ammunition generally was of a rough and primitive description. Towards the middle of the century some improvements were made. Field guns and carriages were lightened and the guns separated into brigades. Siege cartridges were introduced, the ladle being abolished, and shot with wooden bottoms or *sabots* invented. But it was under General Gribeauval, in 1765, that the great reforms in the French artillery were commenced. The field artillery of the new system included 4-pounder regimental guns, and for the park 8 and 12-pounders, with 6-inch howitzers. The ammunition was improved by the introduction of "case" or canisters of sheet iron holding cast iron balls, the old grape and case being abolished.

The carriages were constructed on a uniform model, strengthened with iron, the limber wheels heightened, and the draught diminished. Iron axletrees were introduced, straight pintails on the top of the limbers, and poles took the place of shafts. Boxes on the carriages held part of the ammunition. Traveling trunnion poles were introduced. The horses were harnessed in pairs, instead of in file as formerly, and the *prolong* of rope was introduced to unite the trail of the gun and the limber in slow retiring movements. A new ammunition wagon, carrying fixed ammunition,

was also invented. The service of the guns was improved by the introduction of cross headed elevating screws and tangent scales,—the latter experiments exploding the old false ideas with regard to the absolute flatness of the path of a projectile. The great step made was in a uniform construction being adopted for all *matériel*, and the parts susceptible made interchangeable.

At the commencement of the wars on the Continent in 1793, the British artillery was in anything but an efficient condition. The guns were dispersed among the infantry, they were horsed in single train, the ammunition was packed in rough deal boxes, the ammunition wagons were cumbersome and ill constructed, the drivers were mere carters on foot with long whips, and the whole equipment was scarcely able to break from a foot pace. The battalion or regimental guns were abolished in 1802, and field batteries or "brigades" of six guns were formed, horse artillery batteries being styled troops. Military drivers were introduced, the horses teamed in pairs, the drivers being mounted on the off horses, while eight gunners were carried on the limbers and wagons.

Rifled guns were first used by the British artillery at the siege of Sebastopol, but with no great effect, owing to defective construction. A few years later the introduction of the Armstrong breech-loading rifled gun (first used in the China campaign of 1860) caused a great alteration in the equipment of the British artillery. The system of attaching small arm ammunition wagons to field artillery was abolished, and in future separate "ammunition columns" will convey this as well as reserve ammunition for artillery.

In France a new era for artillery opened with the wars of the consulate and the empire. The *matériel* underwent no great alteration, the 6-pounder being substituted for the 8 and 4-pounders for horse and divisional artillery, and the 24-pound howitzer introduced. But beyond all other changes, we may note the increased tactical employment of artillery under the great artillery officer, Napoleon I. It is to his wars that we first look for instances of the important effects produced by this arm, in that concentration of fire which in those days was only produced by massing guns. In 1852 Napoleon III., when President of the Republic, did much to simplify the *matériel*, and introduced a 12-pounder shell gun, intended to fire solid shot or shrapnel shell. Louis Napoleon had always made artillery a special subject of study; and the great work on artillery commenced and mainly carried out by him is a standard work on the subject. In 1858 rifled guns, 12-pounders and 4-pounders, were adopted in the French service, and used with great effect against the Austrians in the Italian campaign of the following year. Since the war of 1870-71, where the French artillery proved itself markedly inferior both in numbers, power, and handling to that of their adversaries, the French have been actively engaged in carrying on experiments, with a view to the introduction of a superior weapon, and have further increased their force of artillery by 120 batteries.

The *personnel* of the Prussian artillery has developed enormously during the 19th century. In 1808 it formed three brigades, each consisting of six field and two horse artillery batteries. In 1814 it was increased to nine brigades, each composed of twelve field and three horse artillery batteries, besides a proportion of garrison artillery and artificers, and corresponding to one of the permanent army corps of the Prussian army. It was with this organization but slightly modified that Prussia undertook the wars of 1804 and 1866. In 1872 the German artillery was re-

organized, the field artillery of each army corps being augmented to seventeen batteries, and divided into two regiments.

Similar progress was made by the other great European powers during the century. The Austrian artillery has always been pre-eminent both in the excellence of its *matériel* and in tactical handling on the field. In 1859 rifled guns were introduced; and in 1861 gun cotton was substituted for gunpowder, but was soon afterward abandoned. Russia, which specially distinguished itself in the Napoleonic wars by the power and good service of her artillery, has continued to devote the same attention to it. In 1861 she adopted the French system of rifled guns, but after the German war of 1866 she abandoned it for the breech-loading system of Prussia, and has armed her field artillery mainly from the manufactory of Krupp at Essen.

Modern artillery is broadly divided into field, siege, and garrison; and field artillery, again, is divided into mountain, horse, field (or foot), and position artillery. The battery is essentially the unit of artillery organization, both tactical and administrative; and brigades or regiments are formed by combining a number of batteries for convenience of administration.

A battery of field artillery comprises three elements: viz., *matériel*—guns, carriages, ammunition, and stores; *personnel*—officers and non-commissioned officers, gunners to serve, drivers to groom and drive, and artificers. The number of guns in a battery varies from four to eight. Mountain and position batteries have usually four or six field and horse batteries, six or eight guns each. In England, France, and Prussia, there are six guns to a field or horse battery; while Russian or Austrian batteries have eight guns. The latter number seems to possess decided advantages. It admits of more convenient division; and the half-battery of four guns is a small but convenient battery for any particular service.

The distinction between horse and field or foot artillery is another question at present engaging attention. Horse artillery was created to compete with cavalry in rapidity of motion, and for this purpose every man was mounted; while field batteries were supposed to accompany the infantry, and their pace under ordinary circumstances to be limited to that of a man on foot. Under the new conditions of improved firearms, the dash of horse artillery has no longer its former value, while more mobility and more independence of action is required for the field batteries. It is therefore held by many that there should be only two classes of artillery: horse, or very mobile field artillery, and position batteries of heavy guns.

The organization and interior economy of a battery are much the same in all field artillery.

Siege and Garrison Artillery.—Siege and garrison artillery have not usually the complete and permanent organization that distinguishes field artillery. Usually the *matériel* is kept in store, and the *personnel* and transport are supplied from other sources according to requirement. In garrison artillery, the guns mounted on fortresses and batteries, or stored in arsenals for the purpose, furnish the *matériel*, and the battalions or companies of garrison artillery, the *personnel*.

MODERN ARTILLERY IN THE UNITED STATES.

A peaceful nation, seldom in danger of an embroilment such as continually threatens the peoples of continental Europe, would scarcely be expected to be among the first in solving those difficulties of artillery which have in recent years arisen out of the con-

test between guns and armor. This contest is history repeating itself, with the difference that, whereas the question was formerly between men in armor and the crude and ancient guns that first began to be used, the armor is now worn by ships of war, and the guns are such as were thought entirely efficient when the modern ironclad was invented. The contest between these two has gone forward in the United States as elsewhere, and with perhaps more decided results than in any other one country, and it has, besides, taken in the entire scope and practice of artillery in war, bending itself especially to the subject of the improvement of what are now known as "machine-guns." This improvement in field arms will be found to have followed in its development certain prescribed lines which often lead to a revival of old ideas supposed to have been long since exploded. The breech-loading cannon is an ancient idea. One of them was brought by Cortez to Mexico, and is still extant. The Hotchkiss rapid-fire gun is an imitation to a certain extent of the old wall pieces, or the guns mounted on tripods, which were in use four centuries ago. The ideas are old; the improvements enormous.

The claim to distinctively American improvements in modern field arms may be lost sight of in the general course of costly experiments for the past two decades taking place everywhere among civilized peoples. To establish the fact some investigation is necessary, and this leads to certain conclusions that are embodied briefly in the following quotation from the pen of a distinguished engineer and investigator.

"The type of gun, as we make it to-day, is the embodiment of Professor Treadwell's clear idea of a gun of equal strength, as announced in 1843; of Chambers' mechanical ideas of breech-mechanism and of hooping in layers, with the hoops of each layer breaking joints, patented in 1849; of Rodman's elegant exposition of the benefit of procuring initial tension in a gun, published the same year; and finally of Professor Treadwell's extension of this principle to the application of layers of cylinders or hoops in making a built-up gun. All these men were Americans, and were pioneers of these principles, which cover about all the fundamental ones of the built-up gun. The French worked up the breech-mechanism, and Vavaur's practical application of Treadwell's first idea has introduced the jacket piece."

The reader will understand that the great guns of the present late day, among all the civilized nations, embody nothing more than the ideas above alluded to. These were the means, and apparently now the only ones, of producing the effects of a modern artillery fire. Our grandfathers had a cast ball. Our fathers were doubly armed in the possession of a 9-inch shell. We have elongated steel projectiles, sometimes weighing a ton each, that will pierce iron armor whose thickness may be measured by the foot, or even the yard. We are loading some with melinite, or other terrible composition that must play indescribable havoc, or we may, going only a step further in the science of destruction, easily charge them with noxious chemicals that will kill entire battalions and ship's crews. The development along defined lines is clearly shown in this elongated shell. It must be elongated, and must be fired from a rifled gun. Round, it lacked the weight with the same diameter to hold velocity. Elongated, and fired from a gun without rifles, it always developed a tendency to turn end over end in flight, with destroyed efficiency. The twist given by rifles developed the gyroscopic principle, thus invoked in all rifled guns

to keep the outlet head in whirling straight to its mark. But to carry far this modern shell of incredible weight required more powder; therefore, stronger guns, and more space behind the shot to hold powder. The chamber was then too long, and some of the powder was not burned before the ball was gone out of its confinement and beyond any further impulse in the bore. So the chamber was made wider. Then a full width cartridge would not enter at the muzzle unless the bore was as wide as the chamber. Hence one of the absolute necessities became a gun that could be loaded at the breech, though this was only one of the reasons.

The faster a shot travels the further it will go before beginning to fall by gravity and the harder will be the blow delivered. High velocity is equivalent to nearness, therefore the practice is much better and more balls hit the mark. But there came a limit to the quantity of powder that could be burned because of strain upon the gun. Therefore coarse-grained powder, and powder perforated and in prisms, came into use so as to cause slower combustion. Then came the difficulty that in a short gun the ball was not given time enough in the bore to receive the impulse, as in the case of the long powder-chamber, where all the powder would not burn. Hence the long modern cannon which seems a return in some degree to the grotesque and the abandoned. This has brought about the axiom of modern construction of all artillery: *long guns and slow-burning powder.*

But, there being also a natural limit set to this plan, new powders have been invented. To this branch of the subject American ingenuity seems not to have paid great attention, but rather to have been occupied in contriving guns competent to use the explosives invented by others; that is, to make the strongest and most efficient cannon possible. With this all powders must find their limit, and until the gun is made powders will change with innumerable experiments, all valueless without guns of sufficient strength to withstand the strains incident to the throwing of a certain number of pounds a certain distance, with sufficient impact to pierce known resistances. Most of these new powders, almost innumerable, are state secrets. It remains that while guns were not long since made only some twelve calibers in length, they are now thirty or more calibers, the gun being considered only the machine for transmitting to the shot the expansive force of whatever powder will give the greatest velocity to the ball. That powder which will be least in quantity, and will at the same time burn slowest, with the same expansive force of that which burns quickest and is great in quantity, will be the desideratum. Such powders are all mostly made on the principle of high explosives like gun cotton and nitro-glycerine so treated as to make their expansive action slower.

The prevalent idea with students of gunnery and specialists like the members of the Ordnance Board of the U. S. seems to be that guns, as to size, have reached their limit, and the tendency is to recede. As it is, the guns of the Atlanta, 6 inches in diameter and capable of piercing iron plate 6 inches thick almost as though it were pasteboard, can be pulled about in service by one man. The charge of powder for this efficient service weighs less than fifty pounds. It has been concluded that the strain of service requires not necessarily thickness and size, but the best material. The pains and cost expended in this direction once thought theoretical are now conceded to be strictly necessary. This material is *forged steel.*

In firing a gun the strain comes so quickly on the

inner layers that the outer have no time to assist. Hence the original American idea, as mentioned above, of several outer concentric cylinders, the outer compressing the inner, so that this *compression of the outer must be overcome before the strain is felt by the inner*. This was the idea of Rodman in inventing a plan of cooling the interior of a cast gun, and securing the shrinkage of the inner layers before the outer had begun to shrink upon them by cooling first. In its time this was efficient, and answered to the idea, but modern exigencies have exceeded its limit, and the emergency is now met by the forged steel, built-up gun. Contrary to the general idea, a gun of this kind, exceedingly expensive and requiring a long time, exactness and high skill in its manufacture, is long-lived. In length of time they cost no more than cheaper guns. 10-inch guns fired 700 times are still sound.

The process of making a wrought-steel, built-up American gun has been often described. All steel for making 5-inch and 6-inch guns is made in the United States. It has been found that the hammer by which these forgings are made must be as heavy as the finished gun will be. This gigantic appliance, with others, was brought into existence in this country by the passing of acts of Congress so as to make the contract an object to constructors.

The contract was taken, applying also to armor-plates by the Bethlehem Iron Co., of Pennsylvania.

As to what are known as "machine-guns," now an indispensable part of the armament of both army and navy, they have reached in this country a unique development. The "Gatling" was the first successful thing of its kind, and but for the conservatism of officers, who are, or were, as foggyish in this country as in any monarchy, it might have been in use two years before the close of the great war. It is now an equipment of the tops of every navy of the world, and a part of every military equipment. The metallic cartridge, an American invention, made it possible. Indeed, there is nothing that will give the student a more vivid idea of how ideas far apart, and entirely separated, depend for value upon each other, than the study of arms. Then came Maxim, an American, who utilized the idea demonstrated by the Ballistic Pendulum many years ago, to make the recoil of the gun, which necessarily pushes as hard backwards in firing as it does forwards, work the loading and firing mechanism, so that his gun is an automatic, self-loading and self-firing engine of death, once started never stopping of itself so long as there are cartridges.

Hotchkiss, an American, first made his revolving cannon, then his rapid fire guns. The largest of these was of the capacity of ordinary field artillery, being 6-pounders. Mounted on a swivel this piece could be fired from the shoulder like an ancient wall piece, delivering twelve shots a minute. There are now 30, 70, and 100-pounders of the same type. It must be left to the imagination to picture the havoc made by one of these pieces, when, used as a shoulder piece, yet weighing six tons, it places ten shots a minute, each capable of piercing fifteen inches of wrought iron. Such guns are really made, the smaller having already ended, by repute, at least one Indian outbreak since its invention.

In the mounting and handling of the huge guns of the present navy, and of navies in general, electricity, steam, hydraulic and pneumatic power, are all used. While the problem of handling the gun in action has not the importance or the result the making of the gun has, almost as much ingenuity has been expended upon it. Electricity has, indeed, within ten

years grown to be absolutely indispensable in the equipment of a war ship.

It is understood that in all these things except the use of electricity the limit must soon be reached. An armament can only attain a certain efficiency because absolutely controlled by well-known physical laws, one of which is that inversely as the squares of the radii of the interior and exterior surfaces is the strain taken by the two relatively to each other. It follows that in a thick tube the exterior metal aids very little in strengthening. The "spring" of the outside jackets on their interior tubes is the element relied upon in the built-up gun, whose efficiency is now so complete as to place its actual range far outside of the vision of any gunner, and to give it, aside from its impact and penetration, a value which can only be utilized in firing at targets such as cities, whose locality and distance is known. There is an opinion that the latest monsters of Krupp have more than reached the limit of actual utility. The 110-ton gun is now the extreme limit, and it is agreed that smaller guns will do all the work actually required. The rapid-fire principle is limited to ammunition that can be handled by one man. The best limit for all purposes, which seems to have been practically adopted by American officers and ordnance-boards, seems to be a 4-inch gun firing a 36-pound shell. The meaning of this, of course, for all practical fighting purposes, and is in view of the fact that the sizes, calibers and weights no longer have the meaning of former times when "weight of metal," not swiftness and deadly impact, was the criterion of superiority.

ARTOIS, an ancient province of the north of France, corresponding to the present department of Pas de Calais, with the exclusion of the arrondissements of Boulogne and Montreuil, which belonged to Picardy. The name Artois (still more corrupted in "Arras") is derived from the Atrebrates, who possessed the district in the time of Cæsar. From the 9th to the 12th century Artois belonged to the Counts of Flanders. It was bestowed in 1180 on Philip Augustus of France by Philip of Alsace, as the dowry of his niece, Isabella of Hainault. In 1237 it was raised to the rank of a county by Saint Louis in favor of his brother Robert. Philip, the son of Robert II., having died before his father, the transmission of the title was disturbed. The county was claimed by Robert, Philip's son, and his descendants, better known as the counts of Edu, continued to style themselves counts of Artois; but it was actually inherited by Mahaud or Matilda, daughter of Robert II. By her marriage with Otho IV., Artois passed to the house of Burgundy, in whose possession it remained till the marriage of Mary, the daughter of Charles the Bold, to the Archduke Maximilian brought it to the house of Austria. By the peace of Nimeguen it was ceded to France in 1678. The title of count of Artois was borne by Charles X. of France before his accession to the throne.

ARU ISLANDS, a group of about thirty islands, nominally under the Dutch government of the Moluccas, which lie south of New Guinea. Tana-busar, the largest island, is 80 miles from north to south, and is crossed by three river-like creeks running east and west—called Watelai, Vorkai, and Maykor. No part exceeds 100 feet in elevation, but it is only on the coast that the ground is swampy. The principal formation is coralline limestone; the eastern coast is defended by coral reefs, and the neighboring sea is shallow, and abounds in coral in full growth. The other islands of importance are Wamma, Pulo Bali, Oujia, and Wassia.

ARUNDEL, a town in Sussex, on the river Arun, about 4 miles from its mouth, 10 miles E. of Chichester

19 W. of Brighton, and 55 S. W. of London. It confers on its possessor the title of Earl of Arundel. At the time of the Conquest the castle was rebuilt by Roger de Montgomerie, but it was taken from his son, who rebelled against the reigning monarch, Henry I. In 1397 it was the scene of the conspiracy organised by the earl of Arundel, archbishop of Canterbury, and duke of Gloucester, to dethrone Richard II. and murder the lords of his council, a plot which was discovered before it could be carried into execution.

ARUNDEL, THOMAS, Archbishop of Canterbury, born in 1353, was the second son of Robert, earl of Arundel and Warren. At 22 years of age he was raised to the bishopric of Ely, to the church and palace of which he was a great benefactor. In 1386, after the deposition of the earl of Suffolk, he was appointed lord chancellor of England; he was deprived of this office in 1389, but again reinstated. In 1388 he was translated to the see of York, and in 1396 was advanced to the primacy of Canterbury, when he resigned the chancellorship. While bishop of Ely, Arundel had taken a leading part in forcing the king to consent to the commission of regency; Richard never forgave this and in 1397 the parliament, with the king's leave, impeached the archbishop, with his brother Richard earl of Arundel, and the duke of Gloucester, on a charge of high treason. He was sentenced to be banished, and to depart the kingdom within forty days on pain of death. He retired, first to France, and then to the court of Rome, where Pope Boniface IX. gave him a kind reception, and nominated him to the Scottish archbishopric of St. Andrews. He died at Canterbury on the 20th February 1413 of inflammation of the throat, with which he was seized, as was affirmed by the Lollards, while pronouncing sentence upon Lord Cobham.

ARUNDELIAN or OXFORD MARBLES, part of a collection of ancient sculptures and antiquities, including the famous Parian Chronicle, formed by Thomas earl of Arundel, and presented by his grandson, the Hon. Henry Howard (afterwards duke of Norfolk), to the University of Oxford in the year 1667. They were purchased for the first proprietor in 1624 by Mr. (afterward Sir William) Petty, who, along with John Evelyn, had been employed by the earl of Arundel to collect marbles, books, statues, and other curiosities in Italy, Greece, and Asia Minor. On their arrival in London in the year 1627 they were placed in the gardens of Arundel House, the site of which is now occupied by Arundel, Norfolk, Surrey, and Howard Streets in the Strand. Of the large collection now known as the Arundel or Oxford marbles the most remarkable is the Parian Chronicle, or Marmor Chironicon. This when found consisted of a large oblong slab of Parian marble, on which was engraved in capital letters a chronological compendium of the principal events of Greece during a series of 1318 years, beginning with the reign of Cecrops, 1582 B.C., and ending with the archonship of Diognetus, 264 B.C. The marble originally measured 3 feet 7 inches and 2 feet 11 inches on the two sides respectively, its breadth being 2 feet 7 inches; but the chronicle of the last 90 years is lost, so that the part now remaining ends with the archonship of Diotimus, 354 years before the birth of Christ; and in this fragment the inscription is at present so much corroded and effaced that the sense must in some measure be supplied by conjecture.

ARVAL BROTHERS, in *Roman Antiquities*, a college or priesthood, consisting of twelve members, elected for life from the highest ranks in Rome, and always apparently, during the empire, including the emperor. Their chief duty was to offer annually public sacrifice for the fertility of the fields. The origin of the brotherhood was traced to Acca Larentia, the foster-mother of Romu-

lus, who, with her twelve sons, had instituted sacrifices of this kind, and probably this legend arose from the connection of Acca Larentia, as *mater Larum*, with the Lares who had a part in the religious ceremonies of the arvales. But apart from this, there is proof of the high antiquity of the college in the verbal forms of the song with which, down to late times, a part of the ceremony was accompanied, and which is still preserved. It is clear also that, while the members were themselves always persons of distinction, the duties of their office were held in high respect. And yet it is singular that no mention of them occurs in Cicero or Livy, and that altogether literary allusions to them are very scarce. On the other hand, we possess a long series of what may be called the minutes of their proceedings, drawn up by themselves, and inscribed on stone.

ARVE, a river which rises in the Col de Balme, one of the Savoyan Alps, and passing through the valley of Chamouni, falls into the Rhone near Geneva, after a course of about 50 miles. (See *Journ. R. Geog. Soc.*, vol. xxvii.)

ARYAN, a technical term, applied to one of the great families of language, which extends from India to Europe, and which, for that reason, is called also *Indo-European*. Friedrich Schlegel, who first recognized the family relationship of these languages, assigned to them the name of *Indo-Germanic*, a name still used by preference by many scholars in Germany. Bopp decided in favor of *Indo-European* as a more appropriate name for that large family of speech. Other scholars have used the names *Japhetic*, *Sanskritic* and *Mediterranean*.

The objection to *Indo-Germanic* as the technical name of the whole family is that it is too long, and yet not sufficiently extensive. If the family is to be distinguished by the names of its two extreme members, the name ought to be *Indo-Celtic*, rather than *Indo-Germanic*; if by its most important members, then, as remarked by Bopp, the name should be *Indo-Classical*. *Indo-European* is an equally cumbersome name, and less correct even than *Indo-Germanic*, considering that there are many languages spoken both in India and Europe which do not belong to that family. *Sanskritic* would be a misleading name, as countenancing the idea that all the members of this family are derived from Sanskrit. *Japhetic* seems to revive the Jewish conception of the three ancestors of the human race, *Shem*, *Ham* and *Japhet*, and would, from the strictly Hebrew point of view, comprehend many tribes in the north of Asia and Europe who speak Turanian languages. Ewald, who suggested the name of *Mediterranean*, distinguishes, besides the Mediterranean, three other families of speech, the *Northern*, commonly called North Turanian or Altaic, the *Semitic*, and the *Copto-African*. He explains the name of Mediterranean by saying, that "the races speaking these languages inhabited the large central circle, surrounded by Semitic, South-Indian, Chinese, Turko-Tartaric, and Bask languages." The reason why this name has not been accepted; seems to be that locality has little to do with the essential character of languages, and that the central position once occupied by the people who spoke these tongues belongs to them no longer.

Aryan, as a name for a whole family of languages, has the advantage of being short, and, being a word of foreign origin, of lending itself more easily to any technical definition that may be assigned to it. It has been accepted by many writers in England, France, and India. In Germany, too, it is used in this wide sense by Lassen and others, while some scholars have used the term in the more restricted sense of *Indo-Iranian*, —i.e., as comprehending the languages of India and Persia, which constitute the south-eastern as distinct

from the north-western (Greek, Latin, Celtic, Teutonic, Slavonic) branch of the family.

Origin of the Word.—*Aryan*, as a technical term, has been borrowed from the Sanskrit *arya* or *ārya*, the Zend *airya*. In the later Sanskrit *ārya* means, of a good family. It is used as a complimentary address. Originally, however, it was used as a national name, and even as late as the time of the Laws of Manu, India is still called *Āryāvarta*, i. e., the abode of the Aryas. In the Veda, *Ārya* is the name by which the believers in the gods of the Veda call themselves, in opposition to their enemies, who are called *Dāsas* or *Dasyus*.

As *Ārya* had become a proper name as early as the poems of the Peda, its original and etymological meaning would be of little consequence, had it not been used as an additional argument both in favor of and against the technical use of *Ārya*. Professor Bopp derived *arya* from the root *ar*, to go, or even from *ark*, to venerate. The former etymology would give no adequate sense, the latter is impossible. Lassen explains *arya* as *adeundus*, like *ākārya*, teacher. But in explaining *ārya*, it must be remembered that it cannot be separated from *arya* with a short *a*, and that in consequence no etymology of *ārya* can be entertained which does not at the same time account for *arya*. This word is used in the Yagurveda in exactly the same sense as *ārya* in the Rig-veda.

Along the Caspian and in the country washed by the Oxus and Yaxartes, Aryan and non-Aryan tribes were mingled together. Their wars find their poetical record in the Persian epic, the Shahnameh, describing the feuds and friendships between Iran and Turan. Many Scythian names, preserved by Greek writers, have an Aryan character. Beyond the Oxus, in Transoxiana, too, people are mentioned under the name of Ariace and Antariani. Here, however, all certain traces of the word, as a geographical term, vanish. We have indeed Aria as an old name of Thrace, and on the Vistula we meet a German tribe called Aarii; but nothing is known of the origin of these names, and no conclusions should be built on them.

AS, an ancient weight consisting of 12 ounces, identical with the Roman pound.

It was also the name of a Roman coin, which was of different weight and value of different periods. The first introduction of coined money is ascribed to Servius Tullius, who probably borrowed from the neighboring Etruscans the general form and scale of value. The old *as* was composed of the mixed metal *æs*, an alloy of copper and tin, and was called *as libralis*, or *librarius*, because actually weighing a pound or 12 ounces. The *asses* were cast in a mould, and their original shape seems to have been an irregular oblong, which was stamped with the figure of a sheep, ox, or sow. After the round shape was introduced, the one side was always inscribed with the figure of a ship's prow, and the other with the double head of Janus.

ASAFETIDA, a gum-resin obtained principally from *Narthex asafetida*, and probably also from one or two other closely allied species of umbelliferous plants. It is produced in the southern provinces of Persia, in Bokhara, and in Beloochistan, and the plant grows as far south as the Chenab Valley in the Panjab. *Narthex asafetida* grows to a height of from 5 to 6 feet, and when the plant had attained the age of 4 years, it is ready for yielding asafetida. The stems are cut down close to the root, and the juice flows out, at first of a milky appearance, but quickly setting into a solid resinous mass. Asafetida is a valuable nerve sedative, and is an ingredient of most carminative preparations. It is extensively used in medicine.

ASBEN, a country of Central Africa, known also as AIR, which see.

ASBESTOS, or ASBESTUS (*unconsumable*), is a variety of the amphibole or hornblende family of minerals, and akin to tremolite, actinolite, and common hornblende. The chemical composition of the whole family is chiefly silica, magnesia, alumina, and ferrous oxide, but varies considerably. Those containing the most iron are most easily fused. Asbestos consists of fine crystalline elastic fibres, with a silky lustre, varying in color from white to grey and green, and derives its name from being specially indestructible by fire. A single fibre of it fuses to a white enamel, but in the mass it is capable of resisting ordinary flame, and has on this account been regarded from ancient times as a most interesting substance. Woven into cloth it forms a fireproof texture, which, to be purified, requires only to be thrown into the fire; gloves, napery, towels, handkerchiefs, and even dresses have been woven of it; and it is said that the ancients used to wrap the bodies of their dead in abestos cloth to keep their ashes separate from those of the surrounding funeral pile. There are several varieties of asbestos:—(1.) *Amianthus* is the rarest and most delicate kind, its fibres being beautifully white, flexible, long, and regularly laid. (2.) *Common Asbestos* is not so light, either in color or weight, as amianthus, and is more splintery, inflexible, and irregular in structure. (3.) *Mountain leather* and *Mountain cork* are other varieties, where the fibres are less flexible and regular than in either of the above. Their color is brown or a dirty white. *Mountain wood* is a soft, tough, opaque, brownish-colored variety of asbestos, much heavier than the last, and melting to a black slag before the blow-pipe. It is found in Tyrol, in Dauphiny, and in Scotland at Glen Tilt, and Kildrumny.

ASCALON, now ASKULAN, one of the five chief cities of the Philistines, on the coast of the Mediterranean, 12 geographical miles N. of Gaza. It was a well-fortified town, and the seat of the worship of Derceto. The place is now a desolate heap of ruins, with remains of its walls and fragments of granite pillars.

ASCENSION, a solitary island in the Atlantic Ocean, about 7½ miles in length and 6 in breadth, with an area of 34 square miles, and within the immediate influence of the south-east trade wind. It is one of the peaks of a submarine ridge which separates the northern and southern basins of the Atlantic. The whole character of the island is volcanic, and its surface is broken into mountains, hills, and ravines. Ascension is found useful as a station and rendezvous for the vessels employed on the coasts of Africa and Brazil; and letters were formerly often left by passing ships in a crevice in one of the rocks. Population, about 500.

ASCENSION DAY, a festival of the church, held forty days after Easter, or ten days before Whit Sunday, in memory of Christ's ascension into heaven forty days after his resurrection.

ASCETICISM, meaning the exercise or training to which athletes subjected themselves when preparing for the games or contests, is used metaphorically to denote the habitual practice of exercising restraint over, or subduing, the bodily desires and affections which tend to lower objects, in order thereby to advance in the higher life of purity and virtue. It is the means by which the mind withdraws itself from the hindrances and temptations of the world, and clears its vision for what is spiritual and true. In its lowest stage it consists in the mortification of the flesh by fasting, penance, and the like; but in a higher sense it involves the uprooting of all worldly or temporal desires, and withdrawal from the natural relations of life. The origin of such a peculiar

aspect of thought or mode of action is to be found in the wide-spread idea, not wholly Oriental, that in Unity or Identity alone is true goodness or happiness, while in Multiplicity or Difference is evil and misery.

ASCH, a town of Bohemia, in the circle of Eger, at the foot of the Hainberg, with a population of upwards of 9000, carrying on extensive manufactures of woollen, cotton, and other fabrics, as well as of paper, leather, and beer.

ASCHAFFENBURG, a town in the government of Lower Franconia, in the Kingdom of Bavaria, at the confluence of the Aschaffa with the Maine, near the foot of the Spessart-Wald.

The principality of Aschaffenburg, deriving its name from the city, comprehended an area of 336 geographical square miles. It formed part of the electorate of Mentz, and in 1803 was made over to the archchancellor, Archbishop Charles of Dalberg. In 1806 it was annexed to the grandduchy of Frankfurt; and in 1814 was transferred to Bavaria, in virtue of a treaty concluded 19th June between that power and Austria. Conjointly with Lower Franconia, it now forms a circle of the kingdom of Bavaria.

ASCHAM, ROGER, a very distinguished scholar and writer, was born at Kirby Wiske, a village in Yorkshire, near Northallerton, about the year 1515.

The revival of Greek and Roman literature at the period Ascham entered upon his studies was peculiarly favorable to the natural bent of his inclination. A desire of excelling uniformly influenced his conduct; and, adopting the maxim *Qui docet discit*, he began to teach boys the rudiments of the Greek language, as soon as he was acquainted with elementary parts himself. His plan was approved by Pember, and under the direction of this valued friend he soon became acquainted with the best Greek and Latin authors. He devoted himself particularly to Cicero and Cæsar, and from his constant study of these writers acquired the elegant Latin style which proved so honorable and so advantageous in the after part of his life.

His reputation for Greek learning soon brought him many pupils, several of whom afterwards rose to considerable eminence. Of these one of the most distinguished was William Grindall, who obtained the station of master of languages to the Lady Elizabeth, upon the recommendation of Sir John Cheke. In 1544, on the resignation of Cheke, he obtained the appointment of university orator, an office which he retained with great reputation during the period he was connected with the university.

By the advice of his friend Pember, he turned his attention to the study of instrumental music, and thereby enlivened his leisure hours, and prepared his mind for renewed exertion. In his study he also amused himself with embellishing the pages of his manuscripts with beautiful drawings, and in the field he took part in the diversion of archery.

When the crown passed to Elizabeth, it made little alteration in the condition of Ascham, who still retained his station. He spent several hours every day in reading the learned languages with the queen.

In consequence of a conversation which took place in the apartment of Secretary Cecil, upon the subject of education, Sir Richard Sackville, who was present, requested Ascham to write a book on the general subject of education. This work is entitled *The Scholemaster*, and contains many excellent directions to the instructors of youth, particularly with regard to teaching languages, where he recommends the method of double translation. It was published by his widow after his death. By too close application in composing a poem, which he intended to present to the queen on the

New Year's day of 1569, he was seized with an illness which proved fatal. He died on the 23d of December 1568.

ASCHE, RABBI, was the first and chief editor of the *Talmud*. He was born at Babylon in 353 A.D., and was in high repute among his contemporaries for his great learning. He began the Babylonian *Talmud*, and spent 30 years of his life at it. He left the work incomplete, and it was finished by his disciples, Rabbi Abina and Rabbi Jose.

ASCHERSLEBEN, a manufacturing city of Prussia, in the government of Magdeburg, formerly the chief town of a circle. Aschersleben was probably founded in the 11th century by Count Esika of Ballenstedt, the ancestor of the house of Anhalt, whose grandson, Otto, called himself count of Ascanania and Aschersleben, deriving the former part of the title from his castle in the neighborhood of the town. On the death of Otto III. (1315) Aschersleben passed into the hands of the bishop of Halberstadt, and at the peace of 1648, was, along with the bishopric, united to Brandenburg.

ASCLEPIADES, of Prusa in Bythnia, a celebrated physician, flourished at Rome at the end of the 2d century B.C. He travelled much when young, and seems at first to have settled at Rome as a rhetorician. In that profession he did not succeed, but he acquired great reputation as a physician. He founded his medical practice on a modification of the atomic or corpuscular theory, according to which disease results from an irregular or inharmonious motion of the corpuscles of the body. His remedies were, therefore, directed to the restoration of harmony, and in many cases were not unpleasant. He trusted most to changes of diet, accompanied by friction, bathing, and exercise, though he also employed emetics and bleeding. He recommended the use of wine, and in every way strove to render himself as agreeable as possible to his patients. His pupils were very numerous, and the school formed by them was called Methodical. Asclepiades died at an advanced age from the effects of a fall.

ASCOLI, the chief town and a bishop's see in the Italian province of Ascoli Piceno, situated on a rising ground on the river Tronto, a few miles to the west of the Apennines, and commanding a large and fertile plain. Population (1901), 28,882.

Asculum was the chief city of the Piceni, and a place of great strength. It was captured by P. Sempronius Sophus (268 B.C.), but afterwards took an important part in the Social War, and defied for a time the Roman consul Pompeius Strabo. It fell 89 B.C.; Judacilius, its gallant defender, put an end to his life; its magistrates were executed, and its inhabitants banished. At a later period it received a Roman colony, and recovered its prosperity.

ASCONIUS PEDIANUS, QUINTUS, author of some commentaries on Cicero, was born probably a year or two before the Christian era, and died about 83 A.D. He is supposed to have been a native of Padua. Some minor works ascribed to him have been lost; all that are now extant consist of commentaries on some of Cicero's orations. These notes, written in very pure Latin, relate chiefly to matters of law, history, or antiquities, and are very valuable for the light they cast on some obscure parts of Cicero.

ASELLI, ASELIUS, or ASELLIO, GASPARO (born 1581), a physician of Cremona, afterwards professor of anatomy at Pavia. He is best known by his important discovery of the *Lacteal Vessels*.

ASGARD, the home of the *Æsir*, *q.v.*, the Olympus of northern mythology. The city of Asgard is fabled to have been built on the highest part and in the middle of Ida's plain, which is the very centre of the universe.

Here the Æsir erected a court for themselves with seats for twelve, and one high seat for Odin, the All-father, and also a lofty abode for the goddesses, called Vingolf. They worked diligently, played at games, were rich in gold and all precious things, and happy, till three maidens from Jotunheim, the giants' world, crossed Ida's plain, and entered Asaheim, when corruption spread amongst its inmates. Asgard had many mansions, the largest and noblest of which was Glad-sheim; whilst another, not so spacious, but the fairest of all, and brighter than the sun, was called Gimli.

ASGILL, JOHN, an eccentric writer who flourished during part of the 17th and 18th centuries. The exact date of his birth is uncertain. He was bred to the law, and gained considerable reputation, not only by his skill in his profession, but from his first published writings. These consisted of two pamphlets—the first advocating the establishment of some currency other than the usual gold and silver, the second on the registry for titles of lands. In 1703 he took his seat in the Irish Parliament, but was dismissed after four days on account of his so-called blasphemous pamphlet. In 1705 he sat in the English Parliament for Bramber; but in 1707 he was expelled, nominally on account of his unlucky pamphlet, but really, perhaps, because of his debts. The remainder of his life he spent in the Fleet and King's Bench prisons, in one of which he died in 1738. He wrote a number of pamphlets on the Pretender and on the Hanoverian succession.

ASH is the name given to several kinds of trees. The taller or common ash (*Fraxinus excelsior*) belongs to the Natural Order *Oleaceæ*, the olive family. It is distinguished by its fruit, which is dry and winged. Normally the fruit should be two-celled and two-seeded; but generally, by abortion, there is only one cavity and one seed. The Hebrew word *Oren*, translated ash in Isaiah xlv. 14, cannot refer to an ash tree, as that is not a native of Palestine, but probably to the Syrian pine (*Pinus halpensis*). The ash is indigenous in Europe, and also extends to Asia. The tree is distinguished for its height and contour, as well as for its graceful foliage. It is one of the most useful of British trees as regards both timber and rapidity of growth. The tree attains a height of from 50 to 80 feet, and flowers in March and April, before the leaves are developed. It thrives best in a dry, loamy soil, and, as it exhausts the soil in which it grows, it injures plants growing near it. The American ash, a very tough timber, is largely used in carriage building and agricultural implements.

ASH-WEDNESDAY, the first day of Lent, is supposed to have received this name from a custom in the church of sprinkling ashes on the heads of penitents then admitted to penance. The early church did not commence Lent until the following Sunday; the additional days were probably included by Gregory the Great.

ASHANTEE, or SIANTI, a country in Western Africa, in the interior of the Gold Coast, the extent and population of which can only be approximately given. It comprises about 70,000 English square miles, and its population has been variously stated at from 1,000,000 to 3,000,000.

Ashantee proper is covered with almost impenetrable forest. The country round the towns in the interior, however, is cultivated with care, the fields being kept clean, and yielding in abundance grain, yams, vegetables, and fruits. The territory yields also a considerable quantity of gold. The Ashantees are skillful in several species of manufacture, particularly in weaving the great African fabric of cotton. Their pottery and works in gold also show skill, though surpassed by those produced in the more southern countries. A

large quantity of silver-plate and goldsmith's work of great value and considerable artistic elaboration was found in 1874 in the king's palace of Coomassie, not the least remarkable objects being masks of beaten gold.

The government of Ashantee is a mixture of monarchy and military aristocracy; the lower orders being held in complete thralldom, and liable to be put to death or sold into slavery at the will of the chiefs. The king carries on all the ordinary administration of the state; but in questions relating to peace or war he is bound to consult the council of the caboceers or captains. Each of these caboceers keeps a little court, where he makes a profuse display of barbaric pomp. Polygamy is indulged in to an enormous extent, the king having a regular allowance of 3333 wives, but many of these are employed as guards or in menial services. The crown descends to the king's brother or his sister's son, not to his own offspring.

ASHBURTON, a borough and market-town of England, in the county of Devon, 192 miles W. S. W. of London, and 18 from Exeter.

ASHBURTON, ALEXANDER BARING, LORD, born in 1774, was the second son of Sir Francis Baring. In Peel's administration (1834-1835) he was president of the Board of Trade, and was created Baron Ashburton in 1835. In 1842 he was appointed special ambassador to the United States to settle the northwest boundary question, and other disputes. In August of that year he concluded the famous treaty of Washington, by which the frontier line between the State of Maine and Canada was definitely agreed to. Seven-twelfths of the disputed territory, and the British settlement of Madawaska, were given by it to the United States. He died May 13, 1848.

ASHBY-DE-LA-ZOUCH, a market town of England, county of Leicester. Population, 5,000.

ASHDOD. See AZOTUS.

ASHEVILLE, the capital of Buncombe county, North Carolina, occupies a site on the western slope of the Blue Ridge Mountains, within a short distance of the French Broad river, and at the junction of the Tennessee, Virginia and Georgia, and Richmond and Danville railroads. The city contains a court house, half a dozen churches, three schools, a female academy, five banks, two daily and four weekly papers, besides two monthly magazines, with hotels, stores, warehouses and manufacturing establishments, including furniture, carriages, boots and shoes, brooms, tile, artificial stone, tobacco, flour, etc., etc. Population in 1900, 14,694.

ASHFORD, a market-town of England, county of Kent, twelve miles southwest of Canterbury, and fifty-three from London.

ASHLAND, a prominent shipping point in Boyd county, Ky., is situated on the Ohio river, 146 miles north of Cincinnati, and is a railway center of some importance, the Chesapeake and Ohio (Newport News and Mississippi Valley), Ohio and Big Sandy, and the Ashland Coal and Iron Company Railway lines passing through the city. It contains two banks, two weekly papers, five churches, a number of graded schools, a female seminary, quite a number of stores, and other evidences of thrift and enterprise. It is the location of a dry-dock, and extensive manufactures of pig iron and metal products generally, while coal and iron mines, furnaces, etc., are operated in the immediate vicinity. Population, (1900), 6,800.

ASHLAND, the capital of Ashland county, Ohio, and a manufacturing city of growing importance, is situated on what is now the Erie railroad, 106 miles north of Cincinnati, 66 miles south of Cleveland, and 86 miles from Columbus, the state capital. Being thus accessible from all the leading cities

in Ohio and the immediate center of a productive agricultural country, for which it is the depot of supplies, it has grown rapidly in wealth, importance and population. It contains two banks, four weekly papers, also a monthly magazine, ten churches, a high school, besides grammar and intermediate schools, stores, hotels, public halls, and many prominent enterprises of an industrial character. Among the latter are manufactures of steel bed-springs, hullers, pumps, lumber, carriages, jute, paper boxes, patent medicines, cigars, notions, besides other goods of a light character, giving employment to a considerable force of hands, and investment to a large amount of capital. The population in 1900 was 4,087.

ASHLAND, a city of Schuylkill county, Pennsylvania, is located on the Lehigh Valley and Philadelphia and Reading railroads, twelve miles from Pottsville and 119 miles from Philadelphia. The city contains one national bank, eleven churches, four school edifices, a public hall, hotels, and many stores and private residences. The manufactories embrace foundries, machine shops, iron and wire works, lumber mills, etc. The city is in the center of a productive mining region, containing a large number of shafts, all of which are constantly in operation. The population is 6,500.

ASHLAND, the capital of Ashland county, Wis., and one of the most enterprising cities of the northwest, is situated on Chequamegon Bay, Lake Superior, and on the Wisconsin Central; Chicago, St. Paul, Minneapolis and Omaha; Lake Shore and western, and Northern Pacific railroads, 436 miles northwest of Chicago. Its location—possessing the finest harbor on the lake—unsurpassed transportation facilities, the public spirit of its inhabitants, and the natural resources of the surrounding country, have combined to erect Ashland into an influential and leading city within a comparatively brief period. There are now one daily and three weekly papers published in the city; three national banks and one or more private banks are required to meet the demands of business, which is steadily increasing in volume; the commercial, mining and manufacturing interests are largely represented. The city contains ten churches, public buildings costing \$90,000, five school edifices representing an outlay of \$150,000, two public libraries and other incidents of development. More than \$500,000 have been invested in manufacturing plants of various descriptions, the total annual output of which foots up into the millions in value. The city is lighted by gas and electricity, has approved street railway, water and sewage systems and police and fire departments. The assessed valuation of property for 1899 was \$9,500,000, and the city tax \$1.65 per \$100. The population in 1900 was 13,074.

ASHTABULA, the leading city of Ashtabula county, Ohio, and one of the most prominent points in the Western Reserve district, is handsomely situated on the Ashtabula river, three miles from Lake Erie. The city is located with special regard to the promotion of its commercial and manufacturing interests, having direct communication with all ports on the great chain of lakes from Duluth to Buffalo and thence to the sea-board by rail or water, while the Lake Shore and Michigan Southern, New York, Chicago and St. Louis, and Ashtabula and Pittsburgh railroads and their branches furnish unsurpassed accommodations for land traffic in every direction. Three daily, three weekly, two semi-weekly, and one monthly papers are regularly issued, and two banks are conducted. The city also contains churches and graded schools, hotels and public halls, an opera house, etc., besides rolling mills, machine shops and brass works, in addition to manufactories of carriage bows, tools, lumber, agricultural implements,

etc. The city is lighted by gas and electricity and evidences of enterprise are everywhere apparent. The population in 1900 was 12,040.

ASHTON-UNDER-LYNE, or ASHTON, a parliamentary borough in the county of Lancaster, and hundred of Salford, on the northern bank of the river Tame, 6½ miles east of Manchester, and 197 from London. Population, 48,000.

ASIA. This division of the earth's surface embraces the northeastern portion of the great mass of land which constitutes what is generally known as the Old World, of which Europe forms the northwestern and Africa the southwestern region.

The entire surface of the earth being about 196 millions of square miles in area (of which 51 millions are land and 145 millions water), Asia contains about 17 millions of square miles, or say one-third of the whole dry land and one-twelfth part of the whole surface of the globe. Europe contains about 3½ millions of square miles, or close upon one-fifth of the area of Asia; Africa, 11½ millions; and the two Americas together, rather more than 15 millions. The remainder of the land belongs to Australia, the islands of the Eastern Archipelago and the Pacific, and the Antarctic regions.

The northern boundary of Asia is formed by the Arctic Ocean; the coast-line falls between the seventieth and seventy-fifth parallels of N. latitude and so lies within the Arctic circle, having its extreme northern point in Cape Sievero-Vostochny (*i. e., northeast*), in latitude 78° N. On the south the coast-line is far more irregular, the Arabian Sea, the Bay of Bengal, and the China Sea reaching about to the northern tropic at the mouths of the Indus, of the Ganges and of the Canton river; while the great peninsulas of Arabia, of Hindostan, and Cambodia, descend to about the tenth degree of N. latitude, and the Malay peninsula extends within a degree and a half of the equator. On the west the extreme point of Asia is found on the shore of the Mediterranean, at cape Baba, in longitude 26° E. from Greenwich, not far from the Dardanelles. Thence the boundary passes in the one direction through the Mediterranean, and down the Red Sea to the southern point of Arabia, at the straits of Báb-el Mándeb, in long. 45° E.; and in the other through the Black Sea, and along the range of Caucasus, following approximately the 40th degree of N. latitude to the Caspian, whence it turns to the north on a line not far from the 60th meridian, along the Ural Mountains, and meets the Arctic Ocean nearly opposite the island of Nova Zembla. The most easterly point of Asia is Cape Vostochny (*i. e., east*), in long. 190° E., at the entrance of Behring's Straits. The boundary between this point and the extremity of the Malay peninsula follows the coast of the Northern Pacific and the China Sea, on a line deeply broken by the projection of the peninsulas of Kamchatka and Corea, and the recession of the Gulfs of Okotsk, Tonquin and Siam, together with the Yellow Sea.

Owing to the great extent of Asia, it is not easy to obtain a correct conception of the actual form of its outline from ordinary maps, the distortions which accompany projections of large spherical areas on a flat surface being necessarily great and misleading. Turning, therefore, to a globe, Asia, viewed as a whole, will be seen to have the form of a great isosceles spherical triangle, having its northeastern apex at Cape Vostochny, in Behring's Straits; its two equal sides, in length about a quadrant of the sphere, or 6,500 miles, extending on the west to the southern point of Arabia and on the east to the extremity of the Malay peninsula; and the base between these points, occupying



about 60° of a great circle, or 4500 miles, and being deeply indented by the Arabian Sea and the Bay of Bengal on either side of the Indian peninsula. A great circle, drawn through Cape Vostochnyy and the southern point of Arabia, passes nearly along the coast line of the Arctic Ocean, over the Ural Mountains, through the western part of the Caspian, and nearly along the boundary between Persia and Asiatic Turkey. Asia Minor and the north-western half of Arabia lie outside of such a great circle, which otherwise indicates, with fair accuracy, the north-western boundary of Asia. In like manner a great circle drawn through Cape Vostochnyy and the extremity of the Malay peninsula, passes nearly over the coasts of Manchuria, China, and Cochinchina and departs comparatively little from the eastern boundary.

Although for the purposes of geographical nomenclature, boundaries formed by a coast line—that is, by depression of the earth's solid crust *below* the ocean level—are most easily recognised, and are of special convenience; and although such boundaries, from following lines on which the continuity of the land is interrupted, often necessarily indicate important differences in the conditions of adjoining countries, and of their political and physical relations, yet variations of the elevation of the surface *above* the sea level frequently produce effects not less marked. The changes of temperature and climate caused by difference of elevation are quite comparable in their magnitude and effect on all organised creatures with those due to differences of latitude; and the relative position of the high and low lands on the earth's surface, by modifying the direction of the winds, the fall of rain, and other atmospheric phenomena, produces effects in no sense less important than those due to the relative distribution of the land and sea. Hence the study of the mountain ranges of a continent is, for a proper apprehension of its physical conditions and characteristics, as essential as the examination of its extent and position in relation to the equator and poles, and the configuration of its coasts.

From such causes the physical conditions of a large part of Asia, and the history of its populations, have been very greatly influenced by the occurrence of the mass of mountain, which includes the Himalaya and the whole elevated area having true physical connection with that range, and occupies an area about 2000 miles in length and varying from 100 to 500 miles in width, between the 65th and 100th meridians east from Greenwich, and between the 28th and 35th degrees of N. lat. These mountains, which are the highest in the world, rise, along their entire length, far above the line of perpetual snow, and few of the passes across the main ridges are at a less altitude than 15,000 or 16,000 feet above the sea. Peaks of 20,000 feet abound along the whole chain, and the points that exceed that elevation are numerous, the highest hitherto measured being more than 29,000 feet above the sea. A mountain range such as this, attaining altitudes at which vegetable life ceases, and the support of animal life is extremely difficult, constitutes an almost impassable barrier against the spread of all forms of living creatures. The mountain mass, moreover, is not less important in causing a complete separation between the atmospheric conditions on its opposite flanks, by reason of the extent to which it penetrates that stratum of the atmosphere which is in contact with the earth's surface and is effective in determining climate. The highest summits create serious obstructions to the movements of nearly three-fourths of the mass of the air resting on this part of the earth, and of nearly the whole of the moisture it contains; the average height of the entire chain is such as to make

it an almost absolute barrier to one-half of the air and three-fourths of the moisture; while the lower ranges also produce important atmospheric effects, one-fourth of the air and one-half of the watery vapor it carries with it lying below 9000 feet.

This great mass of mountain, constituting as it does a complete natural line of division across a large part of the continent, will form a convenient basis from which to work, in proceeding, as will now be done, to give a general view of the principal countries contained in Asia.

The summit of the great mountain mass is occupied by *Tibet*, a country known by its inhabitants under the name of *Bod*, or *Bodiyul*. *Tibet* is a rugged table-land, narrow as compared to its length, broken up by a succession of mountain ranges, which follow as a rule the direction of the length of the table-land, and commonly rise into the regions of perpetual snow; between the flanks of these lie valleys, closely hemmed in, usually narrow, having a very moderate inclination, but at intervals opening out into wide plains, and occupied either by rivers, or frequently by lakes from which there is no outflow and the waters of which are salt. The eastern termination of Tibet is in the line of Snowy mountains which flank China on the west, between the 27th and 35th parallels of latitude and about on the 103d meridian east. On the west the table-land is prolonged beyond the political limits of Tibet, though with much the same physical features, to about the 70th meridian, beyond which it terminates; and the ranges which are covered with perpetual snow as far west as Samarkhand, thence rapidly diminish in height, and terminate in low hills north of Bukhara.

The mean elevation of Tibet may be taken as 15,000 feet above the sea. The broad mountainous slope by which it is connected with the lower levels of Hindostan contains the ranges known as the Himalaya; the names of Kouenlun, or Karakorum, have been given by some geographers to the northern slope that descends to the central plains of the Gobi, though these mountains are not locally known under those names, Kouenlun being apparently a Chinese corruption of some Turkish or Tibetan word, and Karakorum only one of the many passes that lead from Western Tibet to the northward.

The extreme rigor of the climate of Tibet, which combines great cold with great drought, makes the country essentially very poor, and the chief portion of it little better than desert. The vegetation is everywhere most scanty, and anything deserving the name of a tree is hardly to be found unless in the more sheltered spots, and then artificially planted. The population in the lower and warmer valleys live in houses, and follow agriculture; in the higher regions they are nomadic shepherds, thinly scattered over a large area.

China lies between the eastern flank of the Tibetan plateau and the North Pacific, having its northern and southern limits about on the 40th and the 20th parallels of N. lat. respectively. The country though generally broken up with mountains of moderate elevation, possesses none of very great importance apart from those of its western border. It is well watered, populous, and, as a rule, highly cultivated, fertile, and well wooded; the climate is analogous to that of southern Europe, with hot summers, and winters everywhere cold and in the north decidedly severe.

From the eastern extremity of the Tibetan mountains, between the 95th and 100th meridians, high ranges extend from about lat. 35° N., in a southerly direction, which, spreading outwards as they go south, reach the sea at various points in Cochinchina, the Malayan peninsula, and the east flank of Bengal. Between these ranges, which are probably permanently snowy to about

the 27th degree of N. lat. flow the great rivers of the Indo-Chinese peninsula, the Mekong, the Menám, the Sálwen, and the Irawády, the valleys of which form the main portions of the states of Cochín-China (including Tonquin and Camboja), of Siam (including Laos), and of Burmah. The people of Cochín-China are called Anam, probably from a corruption of their name for the capital of Tonquin, *Kechao*, that the Portuguese *Cochin* has been derived. All these countries are well watered, populous, and fertile, with a climate very similar to that of eastern Bengal. The geography of the region in which the mountains of Cochín China and Siam join Tibet is still very imperfectly known, but there is no ground left for doubting that the great river of eastern Tibet, Tachoktsangpo, supplies the main stream of the Brahmaputra. The two great rivers of China, the Hoang-ho and the Yang-tse-kyang, take their rise from the eastern face of Tibet, the former from the north-east angle, the latter from the south-east. The main stream of this last is called Bri-chu in Tibet, and its chief feeder is the Ya-lung-kyang, which rises not far from the Hoang-ho, and is considered the territorial boundary between China and Tibet.

British India comprises approximately the area between the 95th and 70th meridians, and between the Tibetan table land and the Indian Ocean. The Indian peninsula from the 25th degree of latitude southwards is a table-land, having its greatest elevation on the west, where the highest points rise to over 8000 feet, though the ordinary altitude of the higher hills hardly exceeds 4000 feet; the general level of the table-land lies between 3000 feet as a maximum and 1000 feet.

From the delta of the Ganges and Brahmaputra on the east to that of the Indus on the west, and intervening between the table-land of the peninsula and the foot of the Himalayan slope of the Tibetan plateau, lies the great plain of northern India, which rises at its highest point to about 1,000 feet, and includes altogether, with its prolongation up the valley of Assam, an area of about 500,000 square miles, comprising the richest, the most populous, and most civilized districts of India. This great plain extends, with an almost unbroken surface, from the most western to the most eastern extremity of British India, and is composed of deposits so finely comminuted, that it is no exaggeration to say that it is possible to go from the Bay of Bengal up the Ganges, through the Punjab, and down the Indus again to the sea, over a distance of 2,000 miles and more, without finding a pebble, however small.

The great rivers of Northern India—the Ganges, the Brahmaputra, and the Indus—all derive their waters from the Tibetan mountain mass; and it is a remarkable circumstance, that the waters of almost the whole of the summit of the plateau are carried off into British India between the 95th and 75th meridians, and that the only part of the drainage thrown off to the north, is that of the northern mountain slope.

The population of India is very large, some of its districts being probably among the most densely peopled in the world. The country is generally well cleared, and forests are, as a rule, found only along the flanks of the mountains, where the fall of rain is most abundant. The more open parts are highly cultivated, and large cities abound. The climate is generally such as to secure the population the necessities of life without severe labor; the extremes of heat and drought are such as to render the land unsuitable for pasture, and the people everywhere subsist by cultivation of the soil or commerce, and live in settled villages or towns.

The island of *Ceylon* is distinguished from the neighboring parts of British India by little more than its

separate administration and the Buddhistic religion of its population. The highest point in Ceylon rises to about 9000 feet above the sea, and the mountain slopes are densely covered with forests. The lower levels are in climate and cultivation quite similar to the regions in the same latitude on the Malay peninsula.

Of the islands in the Bay of Bengal, the *Nicobar* and *Andaman* groups are alone worth notice. They are placed on a line joining the north end of Sumatra and Cape Negrais, the southwestern extremity of Burmah. They possibly owe their existence to the volcanic agencies which are known to extend from Sumatra across this part of the Indian Ocean.

The *Laccadives* and *Maldives* are groups of small coral islands, situated along the 73d meridian, at no great distance from the Indian peninsula, on which they have a very slight and ill-defined political dependency.

The portion of Asia west of British India, excluding Arabia and Syria, forms another extensive plateau covering an area as large as that of Tibet, though at a much lower altitude. Its southern border runs along the Arabian Sea, the Persian Gulf, the Tigris, and thence westward to the north-east angle of the Levant; on the north the high land follows nearly the 36th degree or N. lat. to the southern shore of the Caspian, and thence to the Black Sea and Sea of Marmora. *Afghánistán*, *Balüchistán*, *Irán* or Persia, *Armenia*, and the provinces of *Asia Minor*, occupy this high region, with which they are nearly conterminous. The eastern flank of this table-land follows a line of hills drawn a short distance from the Indus, between the mouth of that river and the Himalaya, about on the 72d meridian; these hills do not generally exceed 4000 or 5000 feet in elevation, but a few of the summits reach 10,000 feet or more. The southern and south-western face follows the coast closely up the Persian Gulf from the mouth of the Indus, and is formed further west by the mountain scarp which, rising in many points to 10,000 feet, flanks the Tigris and the Mesopotamian plains, and extends along Kurdistan and Armenia nearly to the 40th meridian; beyond which it turns along the Taurus range, and the north-eastern angle of the Mediterranean. The north-eastern portion of the Afghan table-land abuts on the Himalaya and Tibet, with which it forms a continuous mass of mountain between the 71st and 72d meridians, and the 34th and 36th parallels of N. lat. From the point of intersection of the 71st meridian with the 36th parallel of latitude, which falls nearly on the pass called *Hindukosh* (a name which has been extended by geographers to the ridge on which it is placed), an unbroken range of mountains stretches on one side towards the north-east, up to the crest of the northern slope of the Tibetan plateau, and on the other nearly due west as far as the Caspian. The north-eastern portion of this range is of great altitude, and separates the head waters of the Oxus, which run off to the Aral Sea, from those of the Indus and its Cabul tributary, which, uniting below Pesháwar, are thence discharged southward into the Arabian Sea. The western part of the range, which received the name of Parapomisan Mountains from the ancients, diminishes in height west of the 65th meridian, and constitutes the northern face of the Afghan and Persian plateau, rising abruptly from the plains of the Turkoman desert, which lies between the Oxus and the Caspian. These mountains at some points attain a height of 10,000 or 12,000 feet. Along the south coast of the Caspian this line of elevation is prolonged as the Elburz range (not to be confused with the Elburz of the Caucasus), and has its culminating point in Demavend, which rises to 18,500 feet above the sea; thence it extends to the north-west to Ararat, which rises to upwards of 17,000 feet, from the vicinity of

which the Euphrates flows off to the south-west, across the high lands of Armenia. Below the north-east declivity of this range lies Georgia, on the other side of which province rises the Caucasus, the boundary of Asia and Europe between the Caspian and Black Seas, the highest points of which reach an elevation of nearly 19,000 feet. West of Ararat high hills extend along the Black Sea, between which and the Taurus range lies the plateau of Asia Minor, reaching to the Ægean Sea; the mountains along the Black Sea, on which are the Olympus and Ida of the ancients, rise to 6000 or 7000 feet; the Taurus is more lofty, reaching 8000 or 10,000 feet; both ranges decline in altitude as they approach the Mediterranean.

This great plateau, extending from the Mediterranean to the Indus, has a length of about 2500 miles from east to west, and a breadth of upwards of 600 miles on the west, and nowhere less than 250 miles. It lies generally at altitudes between 2000 feet and 8000 feet above the sea level. Viewed as a whole, the eastern half of this region, comprising Persia, Afghanistan, and Baluchistan, is poor and unproductive. The climate is very severe in winter, and extremely hot in summer. The rainfall is very scanty, and running water is hardly known, excepting among the mountains which form the scarps of the elevated country. The population is sparse, frequently nomadic, and addicted to plunder; progress in the arts and habits of civilisation is small. The western part of the area falls within the Turkish empire. Its climate is less hot and arid, its natural productiveness much greater, and its population more settled and on the whole more advanced.

The peninsula of *Arabia*, with *Syria*, its continuation to the north-west, has some of the characteristics of the hottest and driest parts of Persia and Baluchistan. Excepting the northern part of this tract, which is continuous with the plain of Mesopotamia (which at its highest point reaches an elevation of about 700 feet above the sea), the country is covered with low mountains, rising to 3000 or 4000 feet in altitude, having among them narrow valleys in which the vegetation is scanty, with exceptional regions of greater fertility in the neighborhood of the coasts, where the rainfall is greatest. In Northern Syria the mountains of Lebanon rise to about 10,000 feet, and with a more copious water supply the country becomes more productive. The whole tract, excepting south-eastern Arabia, is nominally subject to Turkey or Egypt, but the people are to no small extent practically independent, living a nomadic, pastoral, and freebooting life under petty chiefs, in the more arid districts, but settled in towns in the more fertile tracts, where agriculture becomes more profitable, and external commerce is established.

The area between the northern border of the Persian high lands and the Caspian and Aral Seas is a nearly desert low-lying plain, extending to the foot of the north-western extremity of the great Tibeto-Himalayan mountains, and prolonged eastward up the valleys of the Oxus and Jaxartes, and northwards across the country of the Kirghiz and Kassaks, to the south-western border of Siberia. It includes *Bukhara*, *Khiva*, and *Turkistan* proper, in which the Uzbek Turks are dominant, and for the most part is inhabited by nomadic tribes, who are marauders, enjoying the reputation of being the worst among a race of professed robbers. The tribes of the north, subject to Russia, are naturally more peaceable, and have been brought into some degree of discipline. In this tract the rainfall is nowhere sufficient for the purpose of agriculture, which is only possible by help of irrigation; and the fixed population (which contains a non-Turkish ele-

ment) is comparatively small, and restricted to the towns and the districts near the rivers.

The most northern extremity of the elevated Tibeto-Himalayan mountain plateau is situated about on the 73d meridian east, and 39° N. lat. This region is known as *Pamir*; it has all the characteristics of the highest regions of Tibet, and so far fitly receives the Russian designation of steppe; but it seems to have no special peculiarities, and the reason of its having been so long regarded as a geographical enigma is not obvious. From it the Oxus, or Amu, flows off to the west, and the Jaxartes, or Sir, to the north, through the Turki state of Kokand, while to the east the waters run down past Kashgar to the central desert of the Gobi, uniting with the streams from the northern slope of the Tibetan plateau that traverse the principalities of *Yarkend* and *Khoten*, which are also Turki. Here the Tibetan mountains unite with the line of elevation which stretches across the continent from the Pacific, and which separates Siberia from the region commonly spoken of under the name of Central Asia.

A range of mountains, called Stanovoi, rising to the heights of 4000 or 5000 feet, follows the southern coast of the eastern extremity of Asia from Kamchatka to the borders of Manchuria, as far as the 135th meridian, in lat. 55° N. Thence, under the name of Yablonoi, it divides the waters of the river Lena, which flows through Siberia into the Arctic Sea, from those of the river Amur, which falls into the North Pacific; the basin of this river, with its affluents, constitutes *Manchuria*. Approximately at right angles to the last named range, another, known as the Khingan, extends between the 120th and 115th meridians, from the 55th to 42d parallel of N. lat., east of which the drainage falls into the Amur and the Yellow Sea, while to the west is an almost rainless region, the inclination of which is towards the central area of the continent, which is *Montolia*.

From the western end of the Yablonoi range, on the 115th meridian, a mountainous belt extends along a somewhat irregular line to the extremity of Pamir, known under various names in its different parts, and broken up into several branches, enclosing among them many isolated drainage areas, from which there is no outflow, and within which numerous lakes are formed. The most important of these ranges is the Thian-shan, or Celestial mountains, which form the northern boundary of the Gobi desert; they lie along the 42d and 43d parallels of N. lat., between the 75th and 95th meridians, and some of the summits are said to exceed 20,000 feet in altitude; along the foot of this range lie the principal cultivated districts of Central Asia, and here too are situated the few towns which have sprung up in this barren and thinly-peopled region. Next may be named the Ala-tau, on the prolongation of the Thian-shan, flanking the Sir on the north, and rising to 14,000 or 15,000 feet. It forms the barrier between the Issik-kul and Balkash lakes, the elevation of which is about 5000 feet. Last is the Altai, near the 50th parallel, rising to 10,000 or 12,000 feet, which separates the waters of the great rivers of Western Siberia from those that collect into the lakes of North-west Mongolia, Zungaria, and Kalka. A line of elevation is continued west of the Altai to the Ural Mountains, not rising to considerable altitudes; this divides the drainage of South-west Siberia from the great plains lying north-east of the Aral Sea.

The central area bounded on the north and northwest by the Yablonoi Mountains and their western extension in the Thian-shan, on the south by the northern face of the Tibetan plateau, and on the east by the Khingan range before alluded to, forms the great desert of Cen-

tral Asia, known as the Gobi. Its eastern part is nearly continuous with South Mongolia, its western forms East Turkistan. It appears likely that no part of this great central Asiatic desert is less than 2000 feet above the sea-level. The elevation of the plain about Kashgar and Yarkend is from 4000 to 6000 feet. The more northern parts of Mongolia are between 4000 and 6000 feet, and no portion of the route across the desert between the Chinese frontier and Kiakhta is below 3000 feet. The precise positions of the mountain ridges that traverse this central area are not properly known; their elevation is everywhere considerable, and many points are known to exceed 10,000 or 12,000 feet.

In Mongolia the population is essentially nomadic, their wealth consisting in herds of horned cattle, sheep, horses, and camels. The Turki tribes, occupying Western Mongolia, are among the least civilised of human beings, and it is chiefly to their extreme barbarity and cruelty that our ignorance of Central Asia is due. The climate is very severe, with great extremes of heat and cold. The drought is very great; rain falls rarely, and in small quantities. The surface is for the most part a hard stony desert, areas of blown sand occurring but exceptionally. There are few towns or settled villages, except along the slopes of the higher mountains, on which the rain falls more abundantly, or the melting snows supply streams for irrigation. It is only in such situations that cultivated lands are found, and beyond them trees are hardly to be seen.

The portion of Asia which lies between the Arctic Ocean and the mountainous belt bounding Manchuria, Mongolia, and Turkistan on the north, is Siberia; it is almost equal in area to the whole of Europe. It is for the most part a low-lying diluvial plain, with a nearly level or slightly undulating surface, which extends eastwards from the Ural Mountain almost to Kamchatka. Beyond the 125th meridian the plain is more broken by hills. The extremes of heat and cold are very great. The rainfall, though not heavy, is sufficient to maintain such vegetation as is compatible with the conditions of temperature, and the surface is often swampy or peaty. The mountain sides are commonly clothed with pine forests, and the plains with grasses or shrubs. The population is very scanty; the cultivated tracts are comparatively small in extent, and restricted to the more settled districts. The towns are entirely Russian. The indigenous races are nomadic Mongols, of a peaceful character, but in a very backward state of civilisation. The Ural Mountains do not exceed 2000 or 3000 feet in average altitude, the highest summits not exceeding 6000 feet, and one of the passes being as low as 1400 feet. In the southern half of the range are the chief mining districts of Russia. The Ob, Yenisei, and Lena, which traverse Siberia, are among the largest rivers in the world.

The southern group of the Malayan Islands, from Sumatra to Java and Timor, extends in the arc of a circle, between the 95th and 127th meridians, and from the 5th degree of N. to the 10th degree of S. lat. The central part of the group is a volcanic region, many of the volcanoes being still active, the summits frequently rising to 10,000 feet or more.

Sumatra, the largest of the islands, is but thinly peopled; the greater part of the surface is covered with dense forest, the cultivated area being comparatively small, confined to the low lands, and chiefly in the volcanic region near the centre of the island. *Java* is the most thickly peopled, best cultivated, and most advanced island of the whole Eastern Archipelago. It has attained a high degree of wealth and prosperity under the Dutch Government. The people are peaceful and industrious, and chiefly occupied with agriculture. The highest of the volcanic peaks rises to 12,000 feet above

the sea. The eastern islands of this group are less productive and less advanced.

Borneo, the most western and the largest of the northern group of islands which extends between the meridians of 110° and 150° E., as far as New Guinea or Papua, is but little known. The population is small, rude, and uncivilised; and the surface is rough and mountainous, and generally covered with forest except near the coast, to the alluvial lands on which settlers have been attracted from various surrounding countries. The highest mountains are supposed to rise to about 10,000 feet, but the ordinary elevations seem not to exceed 4000 or 5000 feet.

Of *Celebes* less is known than of Borneo, which it resembles in condition and natural characteristics. The highest known peaks rise to 8000 feet, some of them being volcanic.

Papua is perhaps somewhat smaller than Borneo. It extends almost to the same meridian as the eastern coast of Australia, from the north point of which it is separated by Torres Straits. Very little is known even of its coasts. The mountains in the interior are said to rise to 20,000 feet, having the appearance of being permanently covered with snow; the surface seems generally to be clothed with thick wood. The inhabitants are of the Negrito type, with curly or crisp and bushy hair; those of the west coast have come more into communication with the traders of other islands, and are fairly civilised. Eastward, many of the tribes are barbarous savages, with whom it is almost impossible for foreigners to hold intercourse.

The *Philippine* islands lie between the 15th and 20th degrees of N. lat., between Borneo and southern China. The highest land does not rise to a greater height than 6000 feet; the climate is well suited for agriculture, and the islands generally are fertile and fairly cultivated, though not coming up to the standard of Java either in wealth or population. The United States Government has since 1898 been established over the group, though a considerable proportion of the people is in some districts still beyond military control.

Formosa, which is situated under the northern tropic, near the coast of China, is traversed by a high range of mountains, reaching nearly 13,000 feet in elevation. On its western side, which is occupied by an immigrant Chinese population, are open and well-cultivated plains; on the east it is mountainous, and occupied by independent indigenous tribes in a less advanced state.

The islands of *Japan* lie between the 30th and 45th parallels. The whole group is traversed by a line of volcanic mountains, some of which are in activity, the highest point being about 13,000 feet above the sea. The country is well watered, fertile, and well cultivated. The people are industrious and intelligent, and show much capacity for mechanical and ornamental art. They have recently attracted special attention from the sudden efforts made by their Government to accept and introduce Western civilisation.

Materials are wanting for anything like a connected sketch of the geological structure of the continent of Asia, and little more can be done than to indicate a few facts which tend to throw light on the probable epochs at which the land has assumed its present configuration.

There is evidence of the very recent formation, speaking geologically, of the great plains of Northern India, of Mesopotamia, and of portions of Central Asia and Siberia. The existence of deposits containing large mammalian remains of the older Pliocene or Miocene divisions of the Tertiary period, has been ascertained at many places on the low lands of British India, in Burmah on the east, along the foot of the Himalaya, and near the Gulf of Cutch on the west, which indicates

that very great changes of level and of conditions of surface have taken place in those localities since the later Tertiary epoch. The far wider spread of the older tertiary proves that far greater alterations have occurred since the Eocene period. Nummulitic limestones are found from Burmah to Eastern Bengal; they are continuous along the flank of the table-land of Baluchistan, through Sindh to the Himalaya; they are frequent throughout Persia, Asia Minor, Syria, Egypt, and along the Caspian; they are found at great elevations in the Himalaya—in one locality at more than 16,000 feet above the sea; all this indicates that over a vast region, which is now dry land, often rising to very great altitudes, there existed a sea area at a period which, geologically speaking, appertains to the more recent epochs of the earth's history. Hence the present configuration of the land must be due to movements of a subsequent date; and it is thus shown that the vast elevation of the great Tibetan table-land is due to changes which are among the latest to which the earth's surface has been subjected. No doubt the Caspian and Aral seas formed part of the ancient ocean which once occupied a great part of what is now Western Asia.

The occurrence of a regular succession of the older fossiliferous deposits, from Upper Silurian upwards to the Triassic and Jurassic, and even to the Cretaceous formations, along the line lying to the north of the highest Himalayan ranges, gives ground for the supposition that an ancient sea-coast may have existed along this line; and that from a still earlier period there was dry land to the south, where the Himalaya now stands. Thus these mountains may have continued, as a chain of some importance, to occupy their present position from a period anterior to the Silurian epoch, while their existing very great elevation is probably due to the disturbances which have taken place since the middle of the Tertiary period.

There is no sufficient evidence of the former extent or distribution of the land south of the Himalaya. But from the absence of marine fossiliferous deposits of the older epochs, it has been inferred that the greater part, at least, of the peninsula of India may have been an area of dry land from a very remote time up to the middle of the Tertiary period, during which the great basaltic formations of Central India are supposed to have been thrown up; a partial submergence then seems to have occurred, followed by a re-elevation, which gave the continent its present form. The fossil remains that have been found indicate the presence, in the Triassic or Permian age, of a great continental area, extending from Europe, and forming a connection across the Indian Ocean between South Africa and the peninsula of India. Grounds also exist for supposing that the Indian peninsula was formerly united by dry land with Australia, and that, when these conditions prevailed, the peninsula was separated by sea from the rest of Asia. Other evidence of this is to be found in the distribution of the races of men, and of plants and animals.

The occurrence of a large area of Silurian and other Palæozoic rocks in Northern Siberia, extending to the Altai mountains, with an apparent absence of the Mesozoic, has been explained as probably due to the existence of a marine area during the Palæozoic epoch, at the close of which it was replaced by an area of land; this was again submerged in the latest Tertiary period, during which a great part of the country was covered with the diluvial deposits, in which are found the remains of large mammalia.

The presence of coal in many parts of China and Mongolia is a further indication of great former changes of condition of the surface in that part of the continent.

Evidence exists of a former far greater extension of glaciers on the Himalaya, possibly at the period during which the great glacial phenomena of Europe occurred; but too little is known to enable us to affirm that this indicates any general period of cold that affected the northern hemisphere as far south as the Himalaya, though the facts are sufficiently striking to suggest such a conclusion. Another explanation of the decrease of Himalayan glaciers is that it was a consequence of the diminution of the fall of snow, consequent on the gradual change of climate which must have followed a gradual transformation of an ocean area into one of dry land. This last-named circumstance would also account for the great changes in the quantity of rain-fall, and in the flow of the rivers, of which there are many indications in Western India, in Persia, and the regions east of the Caspian.

A remarkable feature of Asia is the line of volcanic activity which extends along its eastern coast through Kamchatka, the Kurile and Japanese island, Formosa, and the Philippines, to the Malay archipelago. Thence the line is prolonged to the west, through Java and Sumatra to the Bay of Bengal, where it ends about in lat. 20° N. on the coast of Aracan. To the east and south there also seems to be a connection with the volcanic regions of New Zealand and the islands of the Pacific, and possibly with that of the antarctic land. There is no authentic evidence of active volcanoes in the interior of the continent.

Although these facts give an extremely incomplete view of the geological structure of Asia, they will afford some slight idea of the great changes that have taken place throughout all parts of the continent, and serve to convey a warning of the necessity for taking such changes into account, when attempts are made to understand the manner in which animals and plants are distributed on the earth's surface, and how their development may have taken place. The phenomena of living creatures as now observed are the results of various causes which have been in operation through a long period of time. Those causes which still continue to be in action may, in some respects, call for special attention, as determining the precise conditions under which organisations now have to exist, and as being those which now tend to destroy what has been, and to substitute something different in its place. But what remains necessarily depends on what preceded it, and the knowledge of the conditions and forms of life in the past is an essential element of the proper understanding of life as it now is.

Climate is among the most important of the conditions affecting all forms of life. Under this general term is designated the complicated series of phenomena which arise in the air surrounding any locality, and in the watery vapor diffused through that air. These phenomena, which include the variations of temperature and moisture, the winds, the rain, and electrical condition of the air, depend essentially on the action of solar heat on the atmosphere and the materials of the terrestrial globe. The main conditions which determine the climate of any place, are position on the earth in respect to latitude, elevation above the sea level, and character of the surface in relation to its power of absorbing or radiating heat. Owing to the extreme mobility of the air, its temperature and the quantity of moisture it contains are further influenced in a very important degree by the proximity of large areas of land and water and mountain ranges, and by the position of such areas or ranges in relation to the direction of the earth's motion on its axis. On no portion of the globe are the diversities of climate due to these causes more remarkable, or brought into more striking contrast, than in Asia.

Among the places on the globe where the temperature falls lowest are some in Northern Asia, and among those where it rises highest are some in Southern Asia. The mean temperature of the north coast of Eastern Siberia is but a few degrees above the zero of Fahrenheit; the lowest mean temperature anywhere observed is about 4° Fahr., at Melville Island, north of the American continent. The isothermals of mean annual temperature lie over Northern Asia on curves tolerably regular in their outline, having their western branches in a somewhat higher latitude than their eastern; a reduction of 1° of latitude corresponds approximately—and irrespective of modifications due to elevation—to a rise of $\frac{1}{2}^{\circ}$ Fahr., as far say as lat. 30° N., where the mean temperature is about 75° Fahr. Further south the increase is slower, and the highest mean temperature anywhere attained in Southern Asia is not much above 82° Fahr.

The variations of temperature are very great in Siberia, amounting near the coast to more than 100° Fahr., between the mean of the hottest and coldest months, and to still more between the extreme temperatures of those months. In Southern Asia, and particularly near the sea, the variation between the hottest and coldest monthly means is very much less, and under the equator it is reduced to about 5° . In Siberia the difference between the means of the hottest and coldest months is hardly anywhere less than 60° Fahr. On the sea of Aral it is 80° Fahr.; and at Astrakhan, on the Caspian, more than 50° . At Tiflis it is 45° . In Northern China, at Peking, it is 55° , reduced to 30° at Canton, and to 20° at Manilla. In Northern India the greatest difference does not exceed 40° ; and it falls off to about 15° at Calcutta, and to about 10° or 12° at Bombay and Madras. The temperatures at the head of the Persian Gulf approximate to those of Northern India, and those of Aden to Madras. At Singapore the range is less than 5° ; and at Batavia in Java, and Galle in Ceylon, it is about the same. The extreme temperatures in Siberia may be considered to lie between 70° and 90° Fahr. for maxima, and between -40° and -70° Fahr. for minima. The extreme of heat near the Caspian and Aral seas rises to nearly 100° Fahr., while that of cold falls to -20° Fahr., or lower. Compared with these figures, we find in Southern Asia 110° or 112° Fahr. as a maximum hardly ever exceeded. The absolute minimum in Northern India, in lat. 30° , hardly goes below 32° ; at Calcutta it is about 40° , though the thermometer seldom falls to 50° . At Madras it rarely falls as low as 65° , or at Bombay below 60° . At Singapore and Batavia the thermometer very rarely falls below 70° or rises above 90° . At Aden the minimum is a few degrees below 70° , the maximum not much exceeding 90° .

These figures sufficiently indicate the main characteristics of the air temperatures of Asia. Throughout its northern portions the winter is long and of extreme severity; and even down to the circle of 35° N. lat., the minimum temperature is almost as low as zero of Fahrenheit. The summers are hot, though short in the northern latitudes, the maximum of summer heat being comparatively little less than that observed in the tropical countries further south. The moderating effect of the proximity of the ocean is felt in an important degree along the southern and eastern parts of Asia, where the land is broken up into islands or peninsulas. The great elevation above the sea level of the central part of Asia, and of the table-lands of Afghanistan and Persia, tends to exaggerate the winter cold; while the sterility of the surface, due to the small rain-fall over the same region, operates powerfully in the opposite direction in increasing the summer heat. In the summer a great accumulation of solar heat takes place on the dry surface soil,

from which it cannot be released upwards by evaporation, as might be the case were the soil moist or covered with vegetation, nor can it be readily conveyed away downwards as happens on the ocean. In the winter similar consequences ensue, in a negative direction, from the prolonged loss of heat by radiation in the long and clear nights—an effect which is intensified wherever the surface is covered with snow, or the air little charged with vapor. In illustration of the very slow diffusion of heat in the solid crust of the earth, and as affording a further indication of the climate of Northern Asia, reference may here be made to the frozen soil of Siberia, in the vicinity of Yakutsk. In this region the earth is frozen permanently to a depth of more than 380 feet, at which the temperature is still 5° or 6° Fahr. below the freezing point of water, the summer heat merely thawing the surface to a depth of about 3 feet. At a depth of 50 feet the temperature is about 15° Fahr. below the freezing point. Under such conditions of the soil, the land, nevertheless, produces crops of wheat and other grain from fifteen to forty fold.

The very high summer temperatures of the area north of the tropic of Cancer are sufficiently accounted for, when compared to those observed south of the tropic, by the increased length of the day in the higher latitude, which more than compensates for the loss of heat due to the smaller midday altitude of the sun. The difference between the heating power of the sun's rays at noon on the 21st June, in latitude 20° and in latitude 45° , is only about 2 per cent; while the accumulated heat received during the day, which is lengthened to $15\frac{1}{2}$ hours in the higher latitude, is greater by about 11 per cent. than in the lower latitude, where the day consists only of $13\frac{1}{4}$ hours.

Although the foregoing account of the temperatures of Asia supplies the main outline of the observed phenomena, a very important modifying cause, of which more will be said hereafter, comes into operation over the whole of the tropical region, namely, the periodical summer rains. These tend very greatly to arrest the increase of the summer heat over the area where they prevail, and otherwise give it altogether peculiar characteristics.

The great summer heat, by expanding the air upwards, disturbs the level of the planes of equal pressure, and causes an outflow of the upper strata from the heated area. The winter cold produces an effect of just an opposite nature, and causes an accumulation of air over the cold area. The diminution of the barometric pressure which takes place all over Asia during the summer months, and the increase in the winter, are hence, no doubt the results of the alternate heating and cooling of the air over the continent.

The cultivated plants of the Indian region include wheat, barley, rice, and maize; various millets, *Sorghum*, *Penicillaria*, *Panicum*, and *Eleusine*; many pulses, peas, and beans; mustard and rape; ginger and turmeric; pepper and capsicum; several *Cucurbitaceae*; tobacco, *Sesamum*, poppy, *Crotalaria*, and *Cannabis*; cotton, indigo, and sugar; coffee and tea; oranges, lemons of many sorts; pomegranates, mango, figs, peaches, vines, and plantains. The more common palms are *Cocos*, *Phoenix*, and *Borassus*, supplying cocoa-nut and toddy. Indian agriculture combines the harvests of the tropical and temperate zones. North of the tropic the winter cold is sufficient to admit of the cultivation of almost all the cereals and vegetables of Europe, wheat being sown in November and reaped early in April. In this same region the summer heat and rain provide a thoroughly tropical climate, in which rice and other tropical cereals are freely raised, being as a rule sown early in July, and reaped in September or

October. In southern India, and the other parts of Asia and of the islands having a similar climate, the difference of the winter and summer half years is not sufficient to admit of the proper cultivation of wheat or barley. The other cereals may be seen occasionally, where artificial irrigation is practised, in all stages of progress at all seasons of the year, though the operations of agriculture are, as a general rule, limited to the rainy months, when alone is the requisite supply of water commonly forthcoming.

The trees of India producing economically useful timber are comparatively few, owing to the want of durability of the wood, in the extremely hot and moist climate. The teak, *Tectona grandis*, supplies the finest timber. It is found in greatest perfection in the forests of the west coasts of Burmah and the Indian peninsula, where the rainfall is heaviest, growing to a height of 100 or 150 feet, mixed with other trees and bamboos. The sal, *Shorea robusta*, a very durable wood, is most abundant along the skirts of the Himalaya from Assam to the Punjab, and is found in Central India, to which the teak also extends. The sal grows to a large size, and is more gregarious than the teak. Of other useful woods found in the plains may be named the babool, *Acacia*; toon, *Cedrela*; and sissoo, *Dalbergia*. The only timber in ordinary use obtained from the Himalaya proper is the Deodar, *Cedrus*, not distinct from the cedar of Lebanon. Besides these are the sandalwood, *Santalum*, of Southern India, and many sorts of bamboo found in all parts of the country. The chinchona has recently been introduced with complete success; and the mahogany of America reaches a large size, and gives promise of being grown for use as timber.

The flora of the rainless region of Southwestern Asia is continuous with the desert flora of Northern and Eastern Africa, and extends from the coast of Senegal to the meridian of 75° E., or from the great African desert to the border of the rainless tract along the Indus and the southern parts of the Punjab. It includes the peninsula of Arabia, the shores of the Persian Gulf, South Persia, and Afghanistan, and Baluchistan. On the west its limit is in the Cape de Verde Islands, and it is partially represented in Abyssinia.

Nearly all the mammals of Europe also occur in Northern Asia, where, however, the Palearctic fauna is enriched by numerous additional species. The characteristic groups belong mostly to forms which are restricted to cold and temperate regions. Consequently the Quadrumana, or monkeys, are nearly unrepresented, a single species occurring in Japan, and one or two others in Northern China and Tibet. Insectivorous bats are numerous, but the frugivorous division of this order is only represented by a single species in Japan. Carnivora are also numerous, particularly the frequenters of cold climates, such as bears, weasels, wolves, and foxes. Of the Insectivora numerous forms of moles, shrews and hedgehogs prevail. The Rodents are also well represented by various squirrels, mice, and hares. Characteristic forms of this order in Northern Asia are the marmots (*Arctomys*) and the pikas, or tailless hares (*Lagomys*). The great order of Ungulata is represented by various forms of sheep, as many as ten or twelve wild species of *Ovis* being met with in the mountain chains of Asia; and more sparingly by several peculiar forms of antelope, such as the saiga (*Saiga tatarica*), and the *Gazella gutturosa*, or yellow sheep. Coming to the deer, we also meet with characteristic forms in Northern Asia, especially those belonging to the typical genus *Cervus*. The musk deer (*Moschus*) is also quite restricted to Northern Asia, and is one of its most peculiar types.

The ornithology of Northern Asia is even more closely

allied to that of Europe than the mammal fauna. Nearly three-fourths of the well-known species of Europe extend throughout Siberia into the islands of the Japanese empire. Here again we have an absence of all tropical forms, and a great development of groups characteristic of cold and temperate regions. One of the most peculiar of these is the genus *Phasianus*, of which splendid birds all the species are restricted in their wild state to Northern Asia. The still more magnificently clad gold pheasants (*Thaumalea*), and the eared pheasants (*Crossoptilon*), are also confined to certain districts in the mountains of North-eastern Asia. Amongst the *Passeres*, such forms as the lark, stone chats, finches, linnets, and grosbeaks, are well developed, and exhibit many species.

The mammal fauna of the Indian region of Asia is much more highly developed than that of the Palearctic. The Quadrumana are represented by several peculiar genera, amongst which are *Sennopithecus*, *Hyllobates*, and *Simia*. Two peculiar forms of the Lemurine group are also met with. Both the insectivorous and frugivorous divisions of the bats are well represented. Amongst the Insectivora very peculiar forms are found, such as *Gymnura* and *Tupaia*. The Carnivora are likewise numerous; and this region may be considered as the true home of the tiger, though this animal has wandered far north into the Palearctic divisions of Asia. Other characteristic Carnivora are civets, various ichneumons, and the benturong (*Archictis*). Two species of bears are likewise restricted to the Indian region. In order of rodents, squirrels are very numerous, and porcupines of two genera are met with. The Indian region is the home of the Indian elephant — one of the two sole remaining representatives of the order Proboscidea. Of the Ungulates, four species of rhinoceros and one of tapir are met with, besides several peculiar forms of the swine family.

Of the domesticated animals of Asia may first be mentioned the elephant. It does not breed in captivity, and is not found wild, west of the Jumna river in Northern India. The horse is produced in the highest perfection in Arabia, and the hot and dry countries of Western Asia. Ponies are most esteemed from the wetter regions of the east, and the hilly tracts. Asses are abundant in most places, and two wild species occur. The horned cattle include the humped oxen and buffaloes of India, and the yak of Tibet. A hybrid between the yak and Indian cattle, called zo, is commonly reared in Tibet and the Himalaya. Sheep abound in the more temperate regions, and goats are universally met with; both of these animals are used as beasts of burden in the mountains of Tibet. The reindeer of Northern Siberia call also for special notice; they are used for the saddle as well as for draught.

Asia, including its outlying islands, has become the dwelling-place of all the great families into which the races of men have been divided. By far the largest area is occupied by the *Mongolian* group. These have yellow-brown skins, black eyes and hair, flat noses, and oblique eyes. They are short in stature, with little hair on the body and face. In general terms they extend, with modifications of character probably due to admixture with other types and to varying conditions of life, over the whole of Northern Asia as far south as the plains bordering the Caspian Sea, including Tibet and China, and also over the Indo-Malayan peninsula and Archipelago, excepting Papua and some of the more eastern islands.

Next in numerical importance to the Mongolians are the races which have been called by Professor Huxley *Melanochoirc* and *Xanthochroic*. The former includes the dark-haired people of Southern Europe, and extends over north Africa, Asia Minor, Syria to south-western

Asia, and through Arabia and Persia to India. The latter race includes the fair-haired people of Northern Europe, and extends over nearly the same area as the Melanochroi, with which race it is greatly intermixed. The Xanthochroi have fair skins, blue eyes, and light hair; the others have dark skins, eyes, and hair, and are of a slighter frame. Together they constitute what were once called the Caucasian races. The Melanochroi are not considered by Professor Huxley to be one of the primitive modifications of mankind, but rather to be the result of the admixture of the Xanthochroi with the Australioid type, next to be mentioned.

The third group is that of the *Australioid* type. Their hair is dark, generally soft, never woolly. The eyes and skin are dark, the beard often well developed, the nose broad and flat, the lips coarse, and jaws heavy. This race is believed to form the basis of the people of the Indian peninsula, and of some of the hill tribes of Central India, to whom the name Dravidian has been given, and by its admixture with the Melanochroic group to have given rise to the ordinary population of the Indian provinces. It is also probable that the Australioid family extends into South Arabia and Egypt.

The last group, the *Negroid*, is represented by the races to which has been given the name of *Negrito*, from the small size of some of them. They are closely akin to the negroes of South Africa, and possess the characteristic dark skin, woolly, but scanty beard and body hair, broad flat noses, and projecting lips of the African; and are diffused over the Andaman Islands, a part of the Malay peninsula, the Philippines, Papua, and some of the neighboring islands. The Negritos appear to be derived from a mixture of the true Negro with the Australian type.

The distribution of the Mongolian group in Asia offers no particular difficulty. There is complete present, and probably previous long-existing, geographical continuity in the area over which they are found. There is also considerable similarity of climate and other conditions throughout the northern half of Asia which they occupy. The extension of modified forms of the Mongolian type over the whole American continent may be mentioned as a remarkable circumstance connected with this branch of the human race.

The Mongolians of the northern half of Asia are almost entirely nomadic, hunters and shepherds or herdsmen. The least advanced of these, but far the most peaceful, are those that occupy Siberia. Further south the best known tribes are the Mánchus, the Mongols proper, the Moguls, and the Turks, all known under the name of Tartars, and to the ancients as Scythians, occupying from east to west the zone of Asia comprised between the 40th and 50th circles of N. lat. The Turks are Mahometans; their tribes extend up the Oxus to the borders of Afghanistan and Persia, and to the Caspian, and under the name of Kirghis into Russia, and their language is spoken over a large part of Western Asia. Their letters are those of Persia. The Mánchus and Mongols are chiefly Buddhist, with letters derived from the ancient Syriac. The Mánchus are now said to be gradually falling under the influence of Chinese civilisation, and to be losing their old nomadic habits, and even their peculiar language. The predatory habits of the Turkish, Mongolian and Mánchu population of Northern Asia, and their irruptions into other parts of the continent and into Europe, have produced very remarkable results in the history of the world, to which further reference will be made hereafter.

The Chinese branch of the Mongolian family are a thoroughly settled people of agriculturists and traders. They are partially Buddhists, and have a peculiar mono-

syllabic, uninflected language, with writing consisting of symbols, which represent words, not letters.

The countries lying between India and the Mongolian area are occupied by populations chiefly of the Mongolian and Chinese type, having languages fundamentally monosyllabic, but using letters derived from India, and adopting their religion, which is almost everywhere Buddhist, from the Indians. Of these may be named the Tibetans, the Burmese, and the Siamese. Cochinchina is more nearly Chinese in all respects.

The Malays, who occupy the peninsula and most of the islands of the Archipelago called after them, are Mongols apparently modified by their very different climate, and by the maritime life forced upon them by the physical conditions of the region they inhabit. As they are now known to us, they have undergone a process of partial civilisation, first at the hands of the Brahminical Indians, from whom they borrowed a religion, and to some extent literature and an alphabet, and subsequently from intercourse with the Arabs, which has led to the adoption of Mahometanism by most of them.

The name of *Aryan* has been given to the races speaking languages derived from, or akin to, the ancient form of Sanskrit, who now occupy the temperate zone extending from the Mediterranean, across the highlands of Asia Minor, Persia, and Afghanistan, to India. The races speaking the languages akin to the ancient Assyrian, which are now only represented by Arabic, have been called *Semitic*, and occupy the countries southwest of Persia, including Syria and Arabia, besides extending into North Africa. Though the languages of these races are very different they cannot be regarded as physically distinct, and they are both without doubt branches of the Melanochroi, modified by admixture with the neighboring races, the Mongols, the Australioids, and the Xanthochroi.

The Aryans of India are probably the most settled and civilized of Asiatic races. This type is found in its purest form in the north and north-west, while the mixed races and the population referred to the Australioid type predominate in the peninsula and Southern India. Among the hill tribes of Central India are some which appear to have a Mongolian origin, and to have come in from the north-east, such as the Koles and Bhils. The spoken languages of Northern India are very various, differing one from another in the sort of degree that English differs from German, though all are thoroughly Sanskritic in their vocables, but with an absence of Sanskrit grammar that has given rise to considerable discussion. The languages of the south are Dravidian, not Sanskritic. The letters of both classes of languages, which also vary considerably, are all modifications of the ancient Páli, and probably derived from the Dravidians, not from the Aryans. They are written from left to right, exception being made of Urdú or Hindustaní, the mixed language of the Mahometan conquerors of Northern India, the character used for writing which is the Persian. From the River Sutlej and the borders of the Sindhian desert, as far as Burmah and to Ceylon, the religion of the great bulk of the people of India is Hindu or Brahminical, though the Mahometans are often numerous, and in some places even in a majority. West of the Sutlej the population of Asia may be said to be wholly Mahometan, with the exception of certain relatively small areas in Asia Minor and Syria, where Christians predominate. The language of the Punjab does not differ very materially from that of Upper India. West of the Indus the dialects approach more to Persian, which language meets Arabic and Turki west of the Tigris, and along the Turkoman desert and the Caspian. Through the whole of this tract the letters are used which are common to

Persian, Arabic, and Turkish, written from right to left.

The presence of the Negroid type in isolated Asiatic areas, so far removed from the existing Negro region, appears to require for its explanation the former extension of dry land from Africa across the area now occupied by the Indian Ocean, and the later disappearance of such land by changes of level of the earth's surface. If, again, the relation of the Dravidian (non-Aryan) population of Southern and Central India to that of Australia be real,—and the relationship seems to be sufficiently established,—the presence in India of this race seems also to require the former occurrence of great alterations in the distribution of sea and land across the equatorial region of the Indian Ocean, and probably an alteration or repetition of movements such as our better knowledge of other parts of the earth shows us to have been normal rather than abnormal. That changes on a very great scale have taken place in Southern Asia in the very latest geological periods is well established, and as was before observed, these hypotheses are supported by direct geological evidence, and corroborated by the facts of botanical and zoological distribution.

Of prehistoric man little has yet been discovered in Asia; but a sufficient number of stone and bronze implements or weapons have been found in various parts of India to show that the first steps of the human race in civilisation are everywhere almost identical.

The feeble light thrown on the earliest history of the Aryan race exhibits it as a pastoral people occupying the valleys and mountains along the Oxus. In its proximity to the south were the Semitic races, distributed from Syria to the Euphrates and Persia, and perhaps further east. These two races are seen to have spread across Southern Europe, North Africa, and South-western Asia; the Aryans supplying their language to the greater part of Europe and of the temperate zone of Asia, from the Mediterranean to India; the Semites giving theirs to Arabia, Syria, and North Africa. It is supposed that the population of the area referred to was thus distributed by reason of migration caused by pressure from Mongolian tribes on the north, such as is known to have arisen since the historical period. Possibly the movements may have been due to changes in the climate, and the gradual diminution of the rainfall (of which there is evidence), which might have rendered the area originally occupied by the Aryans unable to support them. But it may be regarded as certain that the Brahminical race, formerly dominant in Upper India, entered that country from the north-west as invaders. The ascertained connection of the languages of India and of the intermediate tract with the ancient Aryan or Vedic language, the fact that the founders of the Brahminical faith fixed themselves in or near the mountains of Northern India, the greater predominance of the Aryan type in this region, the separation of a privileged higher from a servile lower class or caste, and the general evidence of the diffusion of Indian civilisation from west to east, with many other circumstances, tend to corroborate such a view. An intrusion of Aryans into the countries originally occupied by the Semites seems also to have taken place in Iran or Persia. As the Aryan language developed into the Sanskrit in India, so in Persia it gave birth to the Zendic or Hehlvi, the language of the sacred books of the Fire-worshippers; and as the Aryans seem to have borrowed the Dravidian letters in the former country, so they adopted those of the Semites, or ancient Assyrians, in the other. The European branch of the Aryans, the Hellenic races, likewise appear to have no letters of their own, and to have borrowed a Semitic alphabet from the Phœnicians.

The Bactrian Aryans used on archaic quasi-Phœnic an alphabet in North India till 250 B.C., about which time the Pali letters, on which the Devanagari alphabet was based, are known to have been current.

The races that formerly occupied the plains of Mesopotamia and the neighboring mountains—the Babylonians and Assyrians—are, next to the Egyptians, those whose monuments and inscriptions supply the earliest definite records of mankind, going back possibly nearly 4000 years from the present time. These, and the corresponding remains of the Egyptians, which are of even greater antiquity, taking us back perhaps 6000 years or more, indicate that powerful kings then ruled over these countries, with frequent changes in the boundaries of the separate states, under conditions not very greatly different from those that continued until the kingdoms disappeared before the progress of Roman or Mahometan power. How long these races may have taken to arrive at the state of civilisation in which they were as they first become known to us it is impossible to say; but there is nothing to suggest that their condition is to be accounted for otherwise than by prolonged gradual transformations, such as they and all other races are known to have undergone in the time subsequent to that from which our historical records commence.

The earliest event in Hindu chronology which has any pretence to being called historical is the war of the Mahābhārat. The account of this is contained in a poem, written about 500 B.C., which is one of the Vedas. It seems to have been a contest between two branches of the house reigning in Northern India, and to have occurred about 1400 B.C.

Of the western parts of Asia it will suffice to say that about 600 B.C. the kingdoms known under the names of Babylonia, Assyria, Media, and Persia, began to coalesce, and were at length united under Cyrus, the Persian, the "Great King," whose territories are said to have extended from the Mediterranean to the Indus.

During this period the civilisation and learning of Egypt and Western Asia had penetrated into Greece, where was developed, from the branch of the Aryan race which occupied that country, the most extraordinarily intellectual community which has ever existed. The successful resistance of Greece to the advance of the Persians probably prevented the spread of the western Asiatics over Europe, and left that continent open to the evolution of the far higher type of civilisation which is its characteristic. The destruction of the Persian monarchy by Alexander took place about 330 B.C. After the Indian expedition and death of the great Greek conqueror, his Asiatic kingdom fell to pieces, and numerous petty sovereignties were formed out of it. About fifty years before the Christian era, the Romans for the first time appeared on the arena of Asia, took possession of Syria, and soon after occupied a large part of Asia Minor, and at length established themselves on the Tigris. During this interval the more eastern part of the old Persian kingdom, called by the Romans Parthia, had again acquired an independent existence, and its monarch, once more assuming the title of the "Great King," fruitlessly attempted to drive the Romans out of Asia. In the year 274 A.D. later successes of the Romans in the East were celebrated by the famous triumph of the Emperor Aurelian, in which, it is said, ambassadors appeared from all parts of Asia, even from China. The conflicts between the Persians and Romans continued long after the division of the Roman empire 395 A.D., without any material change of the boundaries of the contending parties. The Romans or Byzantines never advanced beyond Armenia or the Tigris; nor could the Persians permanently retain possessions to

the west of those limits, though once (620) they had penetrated to the walls of Constantinople.

While these conflicts were in progress, events of an altogether different character had arisen, which have brought a small portion of Western Asia into prominent notice in the world's history. Christianity had its origin in Syria, among the Jews, a tribe of Semitic race, whose sacred writings and history are of extreme antiquity, and have been preserved and well known by reason of the special interest created in them. The Christian faith spread rapidly over Asia Minor, and soon extended to all parts of the Roman empire, in which it was at length accepted as the state religion about 320 A.D.

Among the efficient agencies of Western progress no doubt can exist that Christianity was one of the most active. It necessarily happened that the religion which established itself on the ruins of the superstitions of the Old World should have an important influence on the new forms of society that arose; and as the Christian faith gradually became dominant and at length the only religion of Europe, it shared greatly, both through its doctrines and its organisation, in bringing about the intellectual and social advance that has there taken place.

But Christianity, though it had its origin in Western Asia, has produced no such consequences there. The progress which it had made to the eastward during the first six centuries was very soon after cut short by the founding of a rival proselytising religion by Mahomet, 620 A.D., whose followers and successors effectually arrested the spread of the Christian faith in this direction.

The Arabs, under the influence of the fanatical preachings of their prophet, now burst forth upon the countries around them; in less than a century, 730 A.D., they had possessed themselves of Persia and Transoxiana, penetrated to the Indus, driven the Byzantine armies out of Asia Minor and Syria, overcome Egypt, advanced along Northern Africa to the Atlantic, had conquered Spain, and even entered France. Nor was this a mere temporary success. Though the Arabs were at once repelled from France, the Mahometans held their ground in Spain for more than seven centuries, and have not only been dominant to the present day in all other parts of their earliest conquests, but have since added largely to the area in which the religion of Mahomet had been adopted.

It was to the immediate successors of Mahomet that our race is indebted for the impulse given to science, which was so long wholly neglected or deliberately condemned by Christian authority in Europe.

The Arab empire, under the khalifs of Baghdad, culminated about 800 A.D., but hardly maintained its integrity fifty years more. On its disruption a Turki dynasty established itself in Ghazni, from which sprung Mahmúd, who first invaded India in 1001, and extended his rule to the Oxus and Persia. His successors (not descendants) established the Mahometan kingdom of Delhi in 1200, which gradually extended over all Northern India in the next two centuries. After Mahmúd's death another Turki house, that of the Seljuks, established itself in Persia, Asia Minor, and Syria, about 1050, extended its authority to Egypt 1170, and retained its vitality till 1300. The Crusades, between 1100 and 1300, set up a small Christian power in Syria, with which the Seljuk Turks were in a state of almost constant conflict, the famous Saladin (Sáláh-u-din) having been one of their chiefs. In the wars between the followers of the crescent and the cross, it is hard to say which inflicted the greatest atrocities on the unfortunate inhabitants of the country around the Holy Sepulchre.

Two centuries before the Christian era the Mongolian races of Central Asia are known to have begun the

series of predatory incursions on their neighbors, which so long made them the terrors of all parts of the Old World less barbarous than their own. The most important of these irruptions took place about 1220. Chenghiz Khán, a Mongolian chief, having made himself master of Central Asia, established his capital at Kárákorum, the precise site of which is doubtful. In 1215 he took possession of Northern China, and then turned westward; he overran the whole of Turkistan, the countries along the Oxus, Afghanistan, and Persia, and added them to his empire. After his death, in 1227, his successors dividing his kingdom among them, continued their advance to the west. They swept away the remains of the Arab khalifs of Baghdad in 1258, and overthrew the Seljuks in Asia Minor in 1300; several of their expeditions for plunder reached India; and they spread themselves over South-eastern Europe into Russia, Hungary, and Poland, and entered Siberia. During this interval, as they became settled, they abandoned the simple deistical faith of their fathers, and adopted the religion of the races they had conquered.

In the year 1370 there rose, above the ordinary level of the successors of Chenghiz, another chief, who claimed descent from the great khan, but was more indebted for his position to his own force of character. From an obscure position in Samárkhand, Timúr, commonly spoken of as Tamerlane by European writers, had acquired in the course of twenty years the sovereignty of Afghanistan, Transoxiana, of Persia as far as the Euphrates, and of Eastern Turkistan to Kásáhgr. His armies reached to Siberia, and he carried his devastations into the heart of Russia, almost to the walls of Moscow. In the years 1398-99, excited by fanaticism and the love of repine, he made his celebrated march into India, an account of which, with his other exploits, exists, written by himself. He plundered and burnt Delhi, which city was surrendered under a solemn promise of protection; he carried off innumerable captives, ravaged the neighboring country, and massacred the Hindu inhabitants to wash out the stains of Musliman blood spilt by his sword; and finally quitted India, leaving anarchy, famine, and pestilence behind him, having in four short months overwhelmed the provinces of Northern Hindustan by calamities which prostrated the kingdom of Delhi for nearly a century. From these ruins the ruthless barbarian turned to the extreme west of Asia, which he ravished with greater ferocity, if possible, than India. After the overthrow of the Seljuk Turks in 1300, the descendants of Chenghiz ruled in Asia Minor for some years. Amid the disorders that accompanied the successions of this dynasty, there started up another adventurer, Osman or Othman, who established himself in the north-western region of Asia Minor, overlooking the Euxine and Sea of Marmora. The descendants of Osman had already become important chiefs, in 1360, when they had driven the Byzantines out of Asia and, under Amurath, established themselves in Europe in the provinces adjoining Constantinople, and had also extended their sway eastward to the Euphrates. It was against Bajazet, the successor of Amurath, that Timúr turned his arms (1400). Aleppo and Damascus were utterly destroyed by him. From Syria, passing the plains of Mesopotamia, where it is said he erected a pyramid of 90,000 heads on the ruins of Babylon, he pursued the Osmanlis into Anatolia; there Bajazet was defeated and made prisoner. Timúr having established his supremacy throughout Western Asia and made the Greek emperor his tributary, turned back to Samárkhand, and died in 1405, on his way to attack China. The successors of Bajazet soon recovered their hold on Asia Minor and Syria, and in 1453 took

Constantinople, and put a final end to the Byzantine power, establishing in its place the Ottoman empire, extending over Greece, the Danubian provinces, and Asia Minor.

Nothing is more remarkable in the history of human societies than the manner in which the ancient civilisation of India has maintained itself through the centuries which have elapsed since the inroads from the West began, the records of which form so large a part of Indian history. Long before the time to which the annals of any part of Europe go back, India had made considerable material and intellectual progress, and the fundamental characteristics of the community at present are probably but little different from what they were 2000 or 3000 years ago. The natural wealth of the country, its open character, and the smaller energy and physical force of its inhabitants, have made it a continual prey to the more warlike nations without, and constant internal wars have completed its political disorganisation, so that the remains of any truly national governments have, with a few fragmentary exceptions, long ceased to exist. But probably few countries that have been subjected to such vicissitudes have changed so little. The well-being of the indigenous population has been preserved in a remarkable degree by that inaptitude to change which appears to be inherent in their race, and which suggests the necessity of the efflux of a very long period of time for the growth of those customs, which have been so little modified since they became fixed in the form described in the ancient Sanskrit writings.

The early history of China affords little to call for remark in such a review as the present. The date of the writings of Confucius is fixed at 550 B.C. The great wall, constructed to oppose the inroads of Mongols from the north, was the work of the Hán dynasty about 200 B.C. About 585 A.D., the whole of China was united into one empire, having previously been governed by many petty chiefs. The first successful invasion of the Mongols under Chenghiz Khan took place in 1234 A.D., and he retained possession of the northern half of the empire, handing it to his son, Kublai-Khan, in 1260, who completed the conquest of the whole country in 1279, and founded the Mongolian dynasty. In his reign Marco Polo, the Venetian traveller, visited China, having traversed the whole of Asia, and from him are derived our first authentic accounts of those countries. The Mongolian dynasty fell, from internal insurrection, in 1366 A.D., when a national government was again set up, once more to be overthrown by an invasion of the Mánchus from the north, about 1643, when commenced the Mánchu dynasty, which has existed till the present time, and from the establishment of which the political importance of the Chinese empire began. The supremacy of the present dynasty of China over Central Asia, and the neighboring states of Eastern Turkistan, dates apparently from about 1680; but it has recently been thrown off in the extreme west by the Turkish races, and is very doubtfully maintained in other distant provinces, and has further been seriously limited in late years by the advances of Russia.

The islands of Japan have maintained an independent position from remote antiquity. Formosa is half occupied by the Chinese, half in possession of independent tribes. The whole island has quite recently, after a threatened conflict with Japan, been recognised as subject to China.

The history of Asia thus far is the record of events brought about by the conflict of forces almost wholly developed within the continent itself. But external influences came into operation by which an altogether new set of conditions was created, leading to consequences

among the most remarkable of any in the world's history. The germs of civilization, which had their origin in Western Asia and Egypt, were thence carried by the Greeks into Europe. In Asia arose the first systems of religion and conceptions of philosophy, which have given scope and food to man's intellectual development; and in it were taken the first steps in the formation of the sciences of observation. But it is to Greeks, instructed in Asiatic learning, that the world is indebted for its further advances. And as Asia no more contributed to this movement which she had started, so she had but little share in its results, or in the benefits it conferred on mankind.

The extension of Russian authority into Northern Asia began about the year 1700, and by the end of the century Russian settlements extended across Siberia to Kamchatka. The advance of this power on the west of Asia into the borders of Turkey, Persia, and Turkistan, and on the east into the outlying provinces of China, is of much later date, and must be regarded as a natural and necessary consequence of the position of a powerful and civilised state brought into contact with barbarous neighbors.

The first introduction and subsequent growth of European power and influence in Eastern and Southern Asia have been almost wholly the result of maritime discovery and enterprise. Under the stimulus of expected commercial gain, and guided by the intelligence of mariners, who, like Columbus, were acquainted with the astronomical teachings of the Arabs, and who, in defiance of the Christian church, believed in the sphericity of the earth, the first of a great series of voyages of discovery was undertaken, which in 1492 gave to Europe its knowledge of America. A few years later the discovery of the passage round the Cape of Good Hope by Vasco di Gama, in 1498, opened out Asia to the commercial enterprise of the maritime nations of Europe. The trade with the East, which had hitherto found a route overland along the Black Sea and Caspian, or up the Red Sea by Egypt, or by the Persian Gulf to Syria, and had been seriously affected by the irruptions of the Mongols, had been centred with the merchants of Genoa and Venice. The opening of the sea route destroyed the monopoly previously established by the Italians, and the Portuguese naturally were the first to benefit by their discovery. The other maritime nations soon followed in their track. A new impetus was thus given to intercourse with Asia, which in a short time altogether changed the current of events in that continent.

The Portuguese landed on the Malabar coast of Hindostan in 1498, and speedily made themselves masters of the Indian Ocean, which they swept with their fleets from Arabia to China. They took Ormuz and Aden, became supreme on the Malabar and Coromandel coasts, in Ceylon and the Malayan islands, and established powerful settlements at the mouth of the Ganges. They first reached China in 1516, and were permitted to establish about twenty years later a factory at Macao, which they still maintain. From that time the intercourse between China and Europe by sea has been regularly and gradually extended. The power of the Portuguese in India, after lasting nearly a century, fell into insignificance, partly by the arms of the Mahometans, partly by the efforts of the Dutch and English — to which latter nation they ceded the island of Bombay in 1661, on the treaty of marriage of Charles the Second.

The Dutch, the Danes, the Spaniards, the French, and the British, all acquired in a similar manner, and (excepting the Danes) still retain settlements of various degrees of importance in India, the Malay peninsula and Archipelago, and China, of which those of the

British in India, Ceylon, and China, of the Dutch in Java and the neighboring islands, of the French in Cambodia, and the Spaniards in the Philippine Islands, alone call for mention. The celebrated Jesuit missionaries, who were long the only authorities on China, first reached Canton in 1579, though Christian teachers had penetrated into the country several centuries before, even, it is said, as early as 635 A.D., and churches were built and converts made in 1274, as reported by Marco Polo. The Jesuits, from their superior knowledge, soon made themselves a powerful body in the state, and their influence was great till about 1700, after which, owing at first apparently to conflicts regarding the limits of the Pope's jurisdiction over the Chinese, they lost favor, and eventually were subjected to positive persecution. They have never regained their former authority. The later intercourse of Europeans with China has introduced some of the forms of Western progress, and opened the empire to commerce.

ASIA MINOR is the name commonly given by geographers to the portion of Western Asia which projects from the main mass of the continent towards the west, between the Black Sea and the eastern basin of the Mediterranean, and which at its north-western extremity approaches so closely to Europe as to be separated from it only by the two narrow straits of the Bosphorus and the Dardanelles. While its boundaries on three sides—the Black Sea on the N., the *Ægean* Sea or Archipelago on the W., and the Mediterranean on the S.—are clearly defined by nature, its eastern boundary is wholly arbitrary and uncertain. The ranges of mountains which extend from the Gulf of Scanderoon, at the north-eastern extremity of the Mediterranean, across to the Black Sea near Trebizond, are so far from forming a continuous range like the Pyrenees, that they are broken into a number of irregular groups and masses, some of which may be regarded as continuations of the Taurus on the south, while others are connected with the highlands and mountains of Armenia on the north; and the great river Euphrates forces its way through the central mass of mountains, nearly at right angles to the general direction of the chain. Hence it is impossible to separate Asia Minor on this side from the adjoining regions of Armenia and Mesopotamia by any real or physical boundary, and for this very reason the political limits have in all ages been very vague and fluctuating. For the purpose of geographical description it may suffice to take a line roughly drawn along the mountain ranges from the Gulf of Scanderoon or Issus to the Euphrates, between Samosata and Malatiah, thence to follow the line of that river to the point near Erzinjan, where it first turns to the south, and thence to draw an imaginary line to the Black Sea, a little to the eastward of Trebizond. The tract extending along the coast eastwards from the latter city to Batum, though included within the limits of Turkey in Asia, belongs in a geographical sense to Armenia rather than to Asia Minor. But whatever line of demarcation be assumed, it must be carefully borne in mind that it does not correspond to any natural boundary.

The term Asia Minor, notwithstanding its ancient form, is of comparatively modern introduction, and was unknown to the principal Greek and Roman geographers.

The name of Anatolia, which is not unfrequently used by modern geographers as synonymous with Asia Minor, is obviously a Greek term derived from a word meaning the sunrise, and thus corresponding exactly to the modern term of "*the Levant*." It appears to have first come into use under the Byzantine empire, and is first found in the works of Constantine Porphyrogenitus in the 10th century. It has been retained in general usage by the Turks, but is employed very irregularly, being

sometimes applied in an administrative sense only to the portion of the peninsula westward of the Halys, at other times extended even beyond the limits which we have assigned to Asia Minor. The use of the latter appellation is therefore decidedly preferable as a geographical term.

The territory comprised within the limits above proposed is about 650 English miles in length, from Malatiah on the Euphrates to the promontory opposite the Island of Scio; but if the line be drawn from Cape Sigeum, at the entrance of the Dardanelles, to the boundary beyond Trebizond, the distance amounts to more than 720 miles. Its greatest breadth from Cape Anamur (Anemurium) on the south coast, to Cape Kerembeh (Carambis) on the north, is just about 6° of latitude, or 420 English miles; but a line drawn from the head of the Gulf of Scanderoon to the nearest point of the Black Sea (at Ordu) does not exceed 300 miles. This may, therefore, be considered as the isthmus by which the peninsula of Asia Minor is joined to the main continent. But very erroneous notions prevailed in ancient times, and even down to a comparatively recent date, with regard to the width from sea to sea, so that the peninsular character of the region to the west of it was greatly exaggerated. Herodotus stated that it was only five days' journey for an active man from the east of Cilicia to Sinope on the Euxine; other authors extended this to seven days; and Pliny gives the distance from Amisus to the Gulf of Issus at only 200 Roman miles (about 185 English miles). Even in the last century the great geographer D'Anville diminished the width of the isthmus between the two seas by a whole degree, or about 70 English miles.

Asia Minor, therefore, can only be termed a peninsula in the same vague and general sense in which that expression is applied to the peninsula of Spain and Portugal. It has been already observed that there are several points of analogy between the two, not only from their forming respectively the westernmost portions of the two continents of Europe and Asia, and occupying much the same position in latitude, but still more in regard to their general conformation and structure. In both cases the interior of the country is occupied by a vast table-land, which forms, as it were, the nucleus of the whole, while ranges of mountains border this elevated tract on all sides, and these again are separated from the sea by valleys or plains at a low level, which are in many cases regions of surpassing fertility. The central plateau of Asia Minor is, however, more extensive than that of the Spanish peninsula, and occupies a much greater portion of the whole country. Beginning on the east with Cappadocia, the whole of which extensive province is more than 3000 feet above the sea, it is continued to the foot of Mount Taurus, by the high table-lands of Lycaonia and Isauria, the former of which is even superior in elevation to Cappadocia; while to the north of these two districts it comprises the whole of Galatia, and by far the greater part of Phrygia, together with portions of the adjoining provinces of Mysia and Bithynia. No part of this extensive region is situated less than 2000 feet above the sea, except where it is occasionally cut into by deep valleys on its northern or western borders.

A tract of such great extent naturally presents great diversity of surface, and is not only varied by extensive undulations, and occasionally by deep valleys, but is traversed in different directions by numerous ranges of mountains, some of them rising to a considerable altitude above the ordinary level of the surrounding plains. These ranges separate the different portions of the great central plateau from one another, and thus divide them into several basins, the waters of which have no direct

communication with each other. One of the most remarkable features in the physical geography of the interior is the fact, that one of the basins thus parted off from the rest, extending nearly 250 miles in length and 150 in breadth, from the sources of the Sangarius and Halys on the north to the great chain of Mount Taurus, has no communication with the sea,—the streams by which it is watered having no outlet, and consequently forming a chain of lakes extending from near Synnada in Phrygia through the whole of Lycaonia, to beyond Tyana in Cappadocia. The most considerable of these lakes is that called, by Strabo, Tatta, and by the Turks, Tuzlah, or the salt pan,—an epithet well deserved from its extreme saltiness, which exceeds even that of the Dead Sea. It is about 45 miles in length by 18 in breadth, but varies much with the season, being very shallow, so that a considerable portion of its surface is dry in summer and covered with incrustations of salt.

North of the region of these lakes lies a dry and naked tract, consisting principally of undulating downs, traversed by the branches and tributaries of the Sangarius and Halys, but otherwise scantily supplied with water, and almost wholly destitute of trees. A portion of this region was in ancient times specially designated as Axylos, or the woodless; but the same epithet might with almost equal propriety be applied to the whole tract extending from Dorylaeum and Cotiaëum, through the north of Phrygia and Galatia, to the confines of Pontus and Cappadocia, a distance of nearly 300 miles. These vast treeless downs afford pasturage at the present day, as they did in the time of Strabo, to numerous flocks of sheep, but they are for the most part uncultivated, and in many places utterly barren and desolate. The few towns that are found within their limits are, however, sometimes surrounded by luxuriant gardens and fruit-trees in great variety.

Mountains.—The orography of Asia Minor is extremely complicated, and is still but imperfectly known, though the researches of recent travellers, especially of Hamilton and Tchihatcheff, have of late years thrown much light on the subject. But very few of the highest ranges have as yet been accurately measured, and the barometrical determinations of the altitudes of numerous points in the interior, which have been made by Hamilton, Ainsworth, and Tchihatcheff, often differ so much from one another, as to render it doubtful how far we can place reliance upon them. At the same time, we are now able, in a general way, to describe and distinguish the more important mountain ranges of the peninsula—a task for which there existed no sufficient materials down to a late period.

By far the most important of these mountain ranges, and that which constitutes one of the leading geographical features of Asia Minor, is the great chain known to modern as well as ancient geographers by the appellation of Mount Taurus. Beginning at the south-western extremity of the peninsula, in the province of Lycia, it extends in a direction nearly parallel with the south coast as far as the south-eastern angle at the confines of Cilicia with Syria,—a distance of more than 400 English miles. Throughout this extent it forms a continuous range of very considerable elevation, constituting a complete natural barrier between the Mediterranean and the great upland plains of the interior; while in some parts, as in Lycia and the western portions of Cilicia, it sends down numerous arms and branches quite to the sea-shore; in others, on the contrary, leaving a broad strip of alluvial plain between the foot of the mountains and the sea. Its positive elevation is very imperfectly known, none of the summits of the great central range having as yet been measured with any degree of accuracy, and the numbers given in the

best maps resting only on the more or less vague estimates of different travellers. It is probable, however, that throughout the greater part of its extent the summits of the main range attain to an elevation of from 7000 to 8000 feet, while many of the higher summits are estimated to exceed 10,000, and in some instances, at least, to approach to 11,000 feet.

At a short distance from the chain of the Taurus and Anti-Taurus to the west, but wholly unconnected with them geologically, or in a true geographical sense, is a remarkable series of volcanic peaks or groups, extending in a direction from N.E. to S.W., through an extent of more than 150 miles. The northernmost and most elevated of these was known to the ancients as Mount Argæus, and is still called by the Turks Erdjish-dagh. It is the highest mountain in Asia Minor, attaining to very nearly (if it does not exceed) 13,000 feet, and its base is upwards of 60 miles in circumference. About 60 miles S.W. of this rises the volcanic mass of Hassandagh, the highest peak of which attains an elevation of above 8000 feet, and which has covered the whole country to the north-east with a vast extent of volcanic deposits. Beyond this, toward the S.W., is situated the volcanic group of Karadja-dagh, of very inferior altitude, but interesting as exhibiting a well-marked series of volcanic cones, having in some instances very well preserved craters, extending through a range of above 35 miles, as far as the village of Kara Bounar. About 25 miles S.W. of this rises the insulated mass of Karadagh, of similar volcanic character, and estimated to attain to a height of about 8000 feet.

Nearly at right angles with the series just described is the range called the Sultan-dagh, which extends through a space of more than 120 miles from the neighborhood of Afium Kara Hissar to that of Konieh.

We now come to consider the numerous mountain chains that branch off from the borders of the great central plateau to the west, and descend to the shores of the Ægean, leaving between them valleys of surpassing beauty and fertility, which were in ancient times thickly studded with towns and cities of Greek origin. As these valleys widen out in approaching the sea, the mountain chains that separate them become clearly marked, and can be readily distinguished; but as we attempt to trace them back towards the interior, it will be found that they often arise in the same knot or cluster of mountain masses, and are in fact only branches radiating from the same point. But as there is no great central chain from which they can be regarded as emanating, it is convenient to describe them separately,—the more so as, from the familiarity of the Greek writers with this portion of Asia Minor, almost every range has some distinctive appellation by which it is well known to scholars.

Almost the whole of the northern provinces of Asia Minor, extending along the coast of the Black Sea—Bithynia, Paphlagonia, and Pontus—are extremely mountainous, and occupied through the greater part of their extent by successive ranges of mountains, filling up the space between the sea-coast and the borders of the great table land of the interior. In a general view these may be characterized as forming a series of vast undulations, more or less parallel with the line of coast, which preserves a general direction from west to east. But when examined more in detail, they will be found to be complicated and broken in a manner that renders their description very difficult, while few of them have any historical importance or special geographical interest. The Olympian range is the most important.

Rivers.—The rivers of Asia Minor are of very little importance in comparison with those of countries of similar extent in Europe. This is owing principally to the existence of the great table-land in the interior, the cli-

mate of which is remarkably dry, and a considerable part of which, as has already been pointed out, does not discharge its waters to the sea. The much steeper inclination of the river-beds, resulting from the high elevation of their sources, tends, moreover, to give them the character of mere torrents, rather than of placid and navigable streams, while at the same time none of them are fed, like the Rhine and the Rhone, by the unfailling supply of glaciers. The want of navigable rivers is, indeed, one of the great defects of the country, and one which, so far as the interior is concerned, must always remain a disadvantage not to be surmounted.

Much the largest river of the peninsula is the Halys, called by the Turks the Kizil Irmak, or "Red River," which derives additional interest from its having formed in early ages the boundary between the kingdoms of Lydia and Persia. It takes its rise in the mountains on the borders of Cappadocia and Pontus, in the district called by Strabo Camisene, about 70 miles above the modern town of Sivas, and flows in a direction nearly S. W. for above 200 miles, till it passes within 20 miles of the city of Kaisariyeh: soon after which it turns to the N. W., and then makes a vast bend round till it assumes a north-easterly direction, which it pursues as far as the town of Osmandjik. Here it makes a sharp and sudden turn, caused by its encountering the range of mountains which extends from Paphlagonia into Pontus, and which it traverses by a winding course through narrow gorges, between precipitous cliffs, until it emerges into the level country near the sea, which it enters about half way between Amisus (Samsoun) and Sinope. Its whole course (as measured on the map, without taking account of the minor windings) is not less than 560 miles, though, from its describing so great a curve, the direct distance from its sources to its mouth is only about 180 miles. In length of course, therefore, it is about equal to such rivers as the Elbe and the Loire, but it is far inferior to them in body of water, in which respect it scarcely equals the second class rivers of France. Even in the lower part of its course its breadth frequently does not exceed 100 yards.

At a short distance east of the mouth of the Halys is that of another of the most considerable streams that fall into the Black Sea—the Iris of ancient geographers, now known as the Yeschil Irmak, or "Green River." This has its source in the same range of mountains as the Halys, but flows from thence towards the N. W. It passes within a short distance of the town of Tokat, and under the walls of Amasia, the birth-place of Strabo, near which it bends abruptly to the N. E., as far as the site of the ancient Eupatoria, where it receives a tributary stream from the E., and thence pursues a course nearly due north for about 40 miles, till it enters the Black Sea about 15 miles east of Samsoun. It has a course altogether of about 200 miles.

The most important of the northern rivers of Asia Minor, after the Halys, is the Sangarius, which still retains its ancient name in the corrupted form of Sakaria. It falls into the Black Sea, W. of Heraclea, about 80 miles from the mouth of the Bosphorus. It has its sources in the uplands of Phrygia, not far to the N. of Afium Kara Hissar, and flows by a very winding course through the great table-land of Galatia, as far as a place called Bei Bazar, about 50 miles W. of Angora, where it turns abruptly to the west, and traverses the mountainous regions of Phrygia and Bithynia, till, after approaching within a short distance of the Sea of Marmora, it again turns to the N. E.; and pursues its course to the Black Sea.

The most considerable rivers which have their outlet to the Sea of Marmora are the Rhyndacus and Macestus, which unite their waters at a distance of about 15 miles

from the sea. They both take their rise in the range of mountains known as the Demirdji-dagh, the Macestus having its source in a small lake called the Simau Göl, a few miles north of Simau (Synnaus), the Rhyndacus in the neighborhood of Æzani, about 25 miles further east. They flow at first in widely divergent directions, but ultimately both turn towards the north; and the Rhyndacus (now called Adranas Tchai), which is the most considerable of the two, after forming the Lake of Apollonia (an extensive sheet of water), receives the waters of the Macestus a few miles lower down.

All these rivers which we have just been considering are remarkable for the great amount of alluvial matter which they bring down, and the extensive deposits which they in consequence form where they enter the sea.

Of the rivers of Lycia the only one which deserves notice is the Xanthus, which rises in Mount Taurus, and falls into the sea about 12 miles below the city of the same name.

The rivers which flow from the main chain of Taurus to the Mediterranean are very numerous, and many of them in winter bring down a large body of water. But they have necessarily but short courses, and few of them have much geographical importance. Of those which traverse the plain of Pamphylia it will be sufficient to mention the Cestrus and the Eurymedon, both of them considerable streams, pursuing parallel courses to the sea, which they enter within less than 20 miles of one another.

The broad alluvial plain which forms the eastern portion of Cilicia is traversed by several rivers, two of which, the Sarus and Pyramus, now known as the Sihun and Jihun, are among the most important rivers of Asia Minor.

Lakes.—The lakes of Asia Minor are numerous, but of no great importance. The most extensive is the great salt lake already noticed, on the borders of Lycaonia and Cappadocia, which is bounded on the east by a considerable range of mountains called Khodja-dagh, while on the west it is separated only by some low hills from the broad upland plains, or steppes, of Lycaonia. Beyond these to the west, but separated from them by the range of the Emir-dagh, is a string of three lakes of no great extent, having a general direction from N. W. to S. E., and following the line of the valley of Phrygia Paroreios. They bear the names of Eber Göl, Ak-Shehr Göl, and Ilgun Göl, and are all basins of fresh water passing into mere marshy pools during the dry season. Much more important than these are the two lakes now known as the Egerdir Göl and Kereli Göl (from towns of those names built upon their banks), which are situated between the range of the Sultan-dagh and the northern offshoots of the Taurus, and are both of them extensive mountain lakes of not less than 30 miles in length. The northernmost of the two (the Egerdir Göl, which is described as the most picturesque and beautiful of the lakes of Asia Minor) is situated at an elevation of about 2800 feet above the sea, while the level of the neighboring Kereli Göl, which is separated from it by an intervening range of mountains, is at least 800 feet higher. Both are perfectly fresh, and their waters clear and deep, though the one has no outlet, and the other communicates only by a small rivulet with the much smaller lake called Soghla Göl, the waters of which occasionally disappear altogether. They are without doubt carried off by subterranean channels. About 30 miles S. W. of the Egerdir Göl is the Lake of Buldur, adjoining the town of that name; and at a short distance north of this lies the Tchörük Su Göl, or Lake of Chardak, the waters of which are extremely salt, so that large quantities of salt are collected there, and sent from thence to Smyrna.

Climate and Natural Productions.—The climate of

Asia Minor necessarily presents great differences. All travellers have remarked on the striking contrast as they passed from the warm and fertile regions of the west and south to the cold and bleak uplands of the interior. The great central plateau, which constitutes so large a part of the country, is not only much colder than regions in corresponding latitudes in Europe, but is characterised by a great dryness, in consequence of the moisture from the Mediterranean being in great part intercepted by the continuous mountain chain of the Taurus. The result of this, combined with its great elevation above the sea, is to render the summers excessively hot, and the winters extremely cold. In both these respects the climate of the central parts of Asia Minor presents a close analogy with that of Central Spain, as well as with the still more extreme case of the neighboring Armenia. On the other hand, the plains and low valleys on the south coast, which are in a latitude corresponding to that of Sicily and the south of Spain, have a mean temperature considerably higher than those countries, and the summer heat at Tarsus is said greatly to exceed that of Cadiz or Gibraltar, and to be nearly equal to that of Cairo. Systematic observations for any length of time are, however, almost wholly wanting. The north coast, on the contrary, is subject to the depressing influence of the cold winds and fogs of the Euxine, which, as is well known, bring down the mean temperature of Constantinople (and still more its winter temperature) far below that of places in corresponding latitudes on the Mediterranean.

The vegetation of the different parts of the peninsula naturally varies with the climate and the soil. The southern coasts present most of the plants and shrubs characteristic of the southern portions of the Mediterranean, with the exception of the prickly pear and American aloe (both of them originally exotics imported into Europe), which form so important a feature in the landscape of Sicily and the south of Spain, as well as of Syria, but are very rare in Asia Minor, while the dwarf palm (*Chamærops humilis*) is wholly wanting. The date palm is occasionally found, but does not ripen its fruit even at Tarsus, where the summer temperature is almost tropical.

Higher up on the mountain slopes and the uplands facing the sea is the chief realm of the oak and pine forests, with which a large part of the chain of Taurus is covered. The walnut is the most plentiful and conspicuous tree around the villages, while vineyards and tobacco fields yield rich produce. The high upland plains, on the contrary, are generally bare and treeless, but the villages are frequently surrounded with walnut trees, Lombardy poplars, apples, apricots, and willows. The vine is still grown in many spots in these elevated regions, though in others it will not thrive. Large tracts of the table-land of the interior, as has been already mentioned, are either quite barren and desolate, or open treeless downs, affording pasture only to sheep.

The northern coast districts present a wholly different climate, and from the influence of the Black Sea and the cold of Russia, have much more of the character of the temperate regions of Europe than of that of Rome or Naples which correspond to them in latitude. But the mountains are covered with extensive forests of oak, chestnut, beech, box, and other trees, while the valleys produce fruit trees in extraordinary abundance and variety.

Among the vegetable productions that are of importance in a commercial point of view, may be mentioned saffron, which is so largely cultivated at a town in Bithynia as to have given it the name of Safaranboli; opium, which has in like manner given name to Afion Kara Hissar; madder, extensively grown at Ak Shehir; the

orchis called salep; and cotton, of which considerable quantities are now produced in the warmer districts near the sea. Mulberries also are extensively cultivated, and large quantities of silk produced in the neighborhood of Broussa, where there are now established large silk manufactories, as well as at Tokat, Amasia, and other places. The dried figs and raisins for which Smyrna is so celebrated are grown principally in the valley of the Mæander near Aidin.

The wild animals of Asia Minor are in general the same as are found in most parts of Europe, though a few mark its connection with the most eastern parts of Asia. Wolves, wild boars, bears and foxes are abundant; but with them is associated the jackal, which is found in large troops in all parts of the country. The lion, which was certainly an inhabitant of Asia Minor in ancient times, is no longer found in any part of the peninsula, and though the tiger is said to exist in the Cilician Taurus, the fact does not rest on any good authority. But leopards still occur not unfrequently in the mountain country of Taurus, and from thence range along the mountains to the west, so that they have been occasionally shot, even in the neighborhood of Smyrna. The high mountains are frequented by the ibex and chamois, while the true wild goat (*Capra Bigagrus*) is found on those of Cappadocia and Cilicia. The moufflon, also, is not uncommon in Cappadocia; but the wild ass, which existed there in the time of Strabo, is no longer found within the limits of the peninsula. The gazelle abounds in the plains of Cilicia, while both fallow and roe deer are found in the forests in large numbers.

Ancient Divisions and Ethnography.—The division of Asia Minor which is commonly adopted by geographers, and which is followed in the present article, is that given by Strabo, which coincides in the main with those of Ptolemy and Pliny. According to this the whole peninsula is considered as comprising—1. Pontus, on the Euxine, adjoining the frontiers of Armenia, and extending west as far as the Halys; 2. Paphlagonia, from the Halys to the Parthenius; 3. Bithynia, from the Parthenius to the Rhyndacus; 4. Mysia, which, with the subordinate districts of the Troad and Æolis, or the land occupied by the Æolian Greek colonists, comprised the north-western angle of the peninsula; 5. Lydia, of which Ionia in like manner formed the sea coast; 6. Caria, including the Dorian Greek colonies; 7. Lycia; 8. Pamphylia; 9. Cilicia—the last three provinces extending along the southern coast, from the Gulf of Macri to the frontiers of Syria; while in the interior were—10. Pisidia, comprising only the rugged mountain country above Pamphylia; 11. Phrygia, forming the western portion of the great table-land; 12. Galatia; 13. Cappadocia; 14. Lycæonia and Isauria, two barren and mountainous regions on the north side of Mount Taurus. (For farther particulars as to the extent and limits of these different regions the reader must be referred to the respective articles.)

Our information concerning the origin and ethnographical relations of the nations that we find occupying the peninsula at the earliest period is very imperfect, and rests almost wholly on the vague statements of ancient authors, none of the nations in question, with the exception of the Lycians, having left any trace of their language.

The population of Asia Minor at the present day can hardly be said to retain any traces of the earlier nations that composed it, though according to some writers, the Zeybeks,—a race presenting some marked peculiarities, who occupy the south-western corner of the peninsula—are the lineal representatives of the ancient Carians. They, however, speak only Turkish. The bulk of the

population is composed of Turks, Greeks, and Armenians, among whom the Turks preponderate greatly in numbers, and (unlike what is the case in European Turkey) compose the mass of the agricultural and rural population, while the Greeks and Armenians are found principally in the towns, where almost all the trade is in their hands. But besides these elements, which constitute the fixed and permanent population of the peninsula, there is a considerable portion consisting of nomad and half nomad tribes, which are known under the names of Turcomans, Yourouks or Euruques (the name is very variously written), and Kurds. The last of these are found principally in the eastern and south-eastern districts, the Turcomans in the north-eastern and central provinces, and the Yourouks in the west and south-west of the peninsula. They are all exclusively pastoral races, but the Turcomans have in general their villages in which they spend the winter months, wandering over the great plains of the interior with their flocks and herds during the summer months. The Yourouks, on the contrary, are a truly nomad race, dwelling all the year round in tents, and removing from place to place according to the season. Their tents are made of black goats' hair, and their principal covering is a heavy cloak of the same material. Besides large flocks of sheep and goats, they breed many camels, and one of their principal occupations is burning charcoal, in the course of which they do enormous injury to the forests.

History.—It is remarkable that a country like Asia Minor, possessing such great natural advantages, and to a great extent so clearly limited by nature, can hardly be said to have any history of its own. It was never at any period united under one independent sovereign, but was always either divided among a number of minor potentates, or, as under the Roman, Byzantine, and Turkish rule, constituted merely a subordinate portion of a more extensive empire. Its western and northern shores were from a very early period occupied by Greek colonies, which gradually formed an almost unbroken chain of settlements along its coasts and islands from Rhodes to Trebizond. But these exercised comparatively little influence upon the nations of the interior; and the first historical event that can be considered as affecting the fortunes of the peninsula in general, was the rise of the Lydian monarchy, which attained to so great a predominance that for a short time Cræsus, the last monarch of the dynasty (560–546 B.C.), had subdued the whole of Asia Minor west of the Halys with the exception of Lycia. But having, unfortunately, engaged in war with Cyrus, king of Persia, he was entirely defeated, and his dominions conquered by the Persian monarch. From this time the whole of Asia Minor, from the frontiers of Syria to the Hellespont and the Bosphorus, continued for more than two centuries to form part of the Persian monarchy, until its overthrow by Alexander the Great, 333 B.C. It was during this period divided into satrapies, the boundaries of which were, however, very uncertain and fluctuating, like those of the Turkish governments in modern days. In the division of the Macedonian empire after the death of Alexander, Asia Minor became a chief object of contention among his generals, but was ultimately included in the dominions of Seleucus, and the greater part of the peninsula continued for a considerable period to be subject to the Seleucidan kings of Syria. A small independent monarchy had, however, been established at Pergamus, soon after 280 B.C., and when the Romans entered Asia and defeated Antiochus III. at the battle of Magnesia (190 B.C.), they transferred a considerable part of his dominions to Eumenes, king of Pergamus, whose kingdom was thus extended to the Taurus. The monarchy of Pergamus thus constituted continued to subsist till after the death of Atta-

lus III., when it was annexed to the Roman dominions under the name of the province of Asia (130 B.C.) Bithynia, however, still continued a separate kingdom, as did also Pontus, which for a short period rose under the great Mithridates to be a really formidable power. But after the defeat and death of Mithridates, in 63 B.C. the greater part of his kingdom, as well as that of Bithynia, was annexed to the Roman dominion; and though some petty dynasties were allowed to linger on till after the Roman empire, the whole of Asia Minor was virtually subject to Rome from the time of Augustus. There ensued a long period of tranquility and prosperity under the Roman and Byzantine empires, during which it suffered less than almost any other part of the empire from the inroads and ravages of barbarians. Even after the rise of the Mahometan power, though Asia Minor was repeatedly traversed by the armies of the Arab conquerors, who twice laid siege to Constantinople, it was never permanently annexed to the dominion of the caliphs, like the adjoining provinces of Syria and Mesopotamia, and the whole country, as far as the passes of Mount Amanus, continued subject to the Byzantine empire, until it was overrun by the Seljukian Turks in 1074 A.D.

The conquest of Asia Minor by the Turks was not a mere passing inroad, but a permanent occupation of the country, in which they established themselves in such numbers that they have ever since formed the predominant element in the population, and have to a great extent supplanted or absorbed all the previously existing races. But the dynasty of the house of Seljuk, established by the first conqueror Soliman, who had fixed his capital at Nice, within 100 miles of Constantinople, did not long retain its undivided sovereignty, and its power was broken by the armies of the first Crusade (1097 A.D.), which took Nice, defeated the Turks in a great battle at Dorylæum, and then swept over the land almost without opposition, up to the very walls of Antioch. The Byzantine emperor recovered possession of the whole circuit of the coast, from Trebizond to the Syrian gates; and the Seljukian sultans of Roum, as they termed themselves, who had removed their capital to Iconium, in the heart of the interior, found themselves cut off from the sea on all sides. Their dominion was gradually broken up, and divided among a number of small independent chieftains, until the rise of the Ottoman dynasty at the commencement of the 14th century once more consolidated the power of the Turks in Asia. The history of Asia Minor from this period is inseparably connected with that of the Turkish empire, and will be given under the head of TURKEY. To the same article we must refer our readers for the modern division of the country and the present system of administration, as well as for such statistical information concerning its present state as it is possible to collect in the absence of all official or trustworthy authorities.

ASKEW, or ASCUE, ANNE, one of the numerous sufferers for the cause of the Reformation in the reign of Henry VIII., was a lady of great worth and beauty, of a good family in Lincolnshire, and in correspondence with Queen Catherine Parr and the chief ladies of the court. At first a Roman Catholic, she had gradually become convinced of the falsity of transubstantiation; and her husband, irritated at her change of religious opinions, compelled her to leave his house. On coming to London to seek for a divorce she was arrested, and interrogated by Chancellor Wriothesley and Bishop Bonner, at the instigation of whom, under threats of torture, she signed a qualified recantation. She was imprisoned, and wrote to the king, says Hume, "that as to the Lord's Supper she believed as much as Christ himself had said of it, and as much of His divine doctrine as the Catholic church had required." But while she

could not be brought to acknowledge the king's explanations, this declaration availed her nothing, and was rather regarded as a fresh insult. She was cruelly racked in the presence, and it was said by the hand, of the chancellor himself, in order to extort confession of those ladies about court with whom she corresponded. Her fortitude and fidelity probably saved the lives of the queen and others. She disclosed nothing, although her limbs were so dislocated by the rack that, when condemned to be burnt alive she could not stand, and was carried in a chair to Smithfield, where on 16th July 1546, she and four others underwent this terrible mode of execution with undaunted courage.

ASMAI or HSMAYI (full name ABU SAÏD ABD-EL-MELEK IBN KORAÏB EL-ASMAÏ), is one of the most important representatives of Arabic literature in the 8th century of the Christian era. He was born at Basra 740 or 741 A. D., and attained, by his extensive erudition, to the high rank of preceptor to Harun-al-Rashid, whose court was in that generation the great focus of intellectual activity in the East.

ASMODEUS, or ASCHMEDAI, an evil demon who appears in later Jewish tradition, and concerning whom there has been much vague and fanciful speculation. The name, probably, means the destroying angel or the tempter. He is sometimes called the prince of demons, and identified with Beelzebub; but there are many other fables regarding his origin. In the apocryphal book of *Tobit* occurs the well-known story of his love for Sara, the beautiful daughter of Raguel, whose seven husbands were slain in succession by him on their respective bridal nights. At last Tobias, by burning the heart and liver of a fish, drove off the demon, who fled to Egypt.

ASMONEUS, or ASSAMONEUS, the first of the dynasty or family of the Asmoneans, who ruled over the Jews about 130 years. His great-grandson was the celebrated Mattathias (died 167 B. C.), the first of the Maccabees; and the direct line of princes descended from him was closed in 37 B. C. by the execution of Antigonus. Agrippa Herodes I. and II. were connected with the Asmoneans through their ancestress, Mariamme, wife of Herod the Great.

ASOLO, the ancient *Acelum*, a fortified town of Northern Italy, in the province of Treviso, about 19 miles distant from the city of that name.

ASP (*Vipera aspis*), a species of venomous snake, closely allied to the common adder of this country, which it represents throughout the southern parts of Europe, being specially abundant in the region of the Alps. The term "asp" seems to have been employed by Greek and Roman writers, and by writers generally down to comparatively recent times, to designate more than one species of serpent; thus the asp, by means of which Cleopatra is said to have ended her life, and so avoided the disgrace of entering Rome a captive, is now generally supposed to have been the cerastes, or horned viper of Northern Africa, a snake about fifteen inches long, exceedingly venomous, and provided with curious horn-like protuberances over each eye, which give it a decidedly sinister appearance. The species, however, to which the word "asp" has been most commonly applied, is undoubtedly the haje (*Naja haje*) of Egypt, a poisonous snake, from three to four feet long, with the skin of its neck loose, so as to render it dilatable at the will of the animal, as in the cobra di capello of India, a species from which it differs only in the absence of the spectacle-like mark on the back of the neck.

ASPARAGUS. The young shoots of *Asparagus officinalis* (Nat. Ord. *Liliaceae*) have from very remote times been in high repute as a culinary vegetable, owing to their delicate flavor and diuretic virtue. The plant

grows wild on the south coast of England; and on the waste steppes of Russia it is so abundant that it is eaten by cattle like grass.

ASPASIA, a beautiful woman of Athens, celebrated in history by her connection with Pericles, was a native of Miletus, and settled in Athens, following the example of her countrywoman, Thargelia, who had become very famous during the time of the Persian wars. Her beauty, but still more her remarkable accomplishments, gained for her an extraordinary reputation, which was increased after her association with Pericles, who, having divorced his wife, united himself to Aspasia as closely as was possible under Athenian law, according to which marriage with a barbarian was illegal and impossible. Much of the administration of Pericles has been ascribed to her eloquent instruction and political sagacity, and her enemies did not scruple to lay to her charge the Samian and Peloponnesian wars. Although this exaggerates her power, yet her talents must have been extraordinary, for she drew to her house the most noble and learned in Athens, who were willing to learn from her. Even Socrates was not exempt from her influence. The political supremacy of Pericles, which exposed him to many assaults, attracted enmity to Aspasia. She was accused of impiety and other base crimes, and would probably have been condemned, had not the judges been swayed by the tears and entreaties of Pericles himself. After the death of that statesman's two sons by his lawful wife, he procured the passing of a law, by which the children of irregular marriages might be rendered legitimate. His son by Aspasia was thus allowed to assume his father's name. After the death of Pericles, Aspasia is said to have formed a similar connection with one Lysicles, wealthy, but of ignoble birth, whom she raised by her instructions to a prominent place in the state. This episode is somewhat obscure, especially as Lysicles seems to have fallen in battle in 428, the year after the death of Pericles. Nothing further is known of the history of Aspasia.

ASPASIUS, a Peripatetic philosopher, and one of the most prolific commentators on Aristotle, flourished probably towards the close of the first century A.D., or perhaps during the reign of Antoninus Pius.

ASPASIUS, a celebrated rhetorician and sophist, was born at Ravenna, and flourished during the early part of the 3d century A.D.

ASPEN TREE, called also the trembling-leaved poplar (*Populus tremula*), is a native of Britain, and is found generally in moist places, sometimes at a considerable elevation, 1,600 feet or more, in Scotland. It flowers in Britain in March and April. The name "trembling" is applied to it on account of the constant movement of the leaves even with a gentle breeze.

ASPENDUS (or, as the name appears on the more ancient coins, ESTFENDYS), a city of Pamphylia, in Asia Minor, situated on an isolated hill near the river Eurymedon (*Capri-su*) at the extremity of the plain of Perga. It was founded by a colony from Argos, five centuries before the Christian era, and attained to great prosperity, as is attested, not only by the statements of Greek and Roman writers, but also by the noble ruins that still occupy the site.

ASPER, HANS, a Swiss painter, was born in 1499 at Zürich, where he died on the 21st March, 1571. He wrought in a great variety of styles, but excelled chiefly in flower and fruit pieces, and in portrait painting. Many of his pictures have perished, but his style may be judged from the illustrations to Gessner's *Historia Animalium*, for which he is said to have furnished the designs, and from portraits of Zwingli and his daughter Regula Gwalter, which are preserved in the public library of Zürich.

ASPHALT, or ASPHALTUM, the German *Bergpech*, or mineral pitch, so called from the *Lacus Asphaltites* or Dead Sea, where it was found in ancient times, is a product of the decomposition of vegetable and animal substances. It is usually found of a black or brownish-black color, externally not unlike coal, but it varies in consistency from a bright pitchy condition, with a sharp conchoidal fracture, to thick viscid masses of mineral tar. Asphalt melts at or a little below the boiling point of water, and it burns with a rather smoky flame. It is regarded as the ultimate result of a series of changes which take place, under certain conditions, in organized matter, producing—1st, naphtha; 2d, petroleum; 3d, mineral tar; and 4th, asphalt or hard bitumen. The whole of these substances merge into each other by insensible degrees, so that it is impossible to say at what point mineral tar ends and asphalt begins. Naphtha, which is the first of the series, is in some localities found flowing out of the earth as a clear, limpid, and colorless liquid. As such it is a mixture of hydrocarbons, some of which are very volatile and evaporate on exposure; it takes up oxygen from the air, becomes brown and thick, and in this condition it is called petroleum. A continuation of the same process of evaporation and oxidation gradually transforms the material into mineral tar, and still later into solid glassy asphalt. Asphaltic deposits exist widely diffused throughout the world, more especially in tropical and sub-tropical regions. It is found in a state of great purity in the interstices of the older rocks, but its occurrence is not characteristic of any particular formation or period. The most remarkable deposit of asphalt exists in Trinidad, where it forms a lake 99 acres in extent, and of unknown depth, intersected with rivulets of water.

Of greater importance industrially than simple asphalt is asphalt stone,—a limestone impregnated with bituminous matter, which occurs in large quantities at several European localities.

Two principal methods are adopted in laying asphalt pavements,—1st, the mastic process; 2d, the hot compressed process. The mastic process is essentially as follows:—The bed of the road-way is prepared with a smooth level foundation of concrete, which must be thoroughly dry before the application of the asphalt. The mastic is prepared for application by heating the asphaltic stone and breaking it into small pieces, which are then melted up with a quantity of mineral tar, to which some sand is added. The molten mass is then poured over a section of the prepared concrete uniformly to the requisite depth; the surface is smoothed, and covered with a coating of fine sand which is stamped into the asphalt. The proportions of sand used vary with the composition of the asphaltic stone employed and the position occupied by the pavement. The other mode of laying pavements, now extensively adopted, consists in spreading hot powdered asphaltic stone on the prepared surface, which is then heavily pressed till it forms a homogeneous elastic coating. Roadways so prepared are very durable, smooth, cleanly, and noiseless, but the material is not well adapted for other than level streets on account of the difficulty of foothold.

ASPIXYIA, a term in medicine which, though literally signifying loss of pulsation, is applied to describe the arrestment of the function of respiration from some hindrance to the entrance of air into the lungs. (See **PHYSIOLOGY** and **MEDICAL JURISPRUDENCE**.)

ASPINWALL, or COLON, a city and free port on the northern coast of Panama, one of the United States of Colombia. It is built on the well-wooded coral island of Manzanilla, in lat. 9° 22' 53" N., and long. 79° 52' 58" W., owes its origin to the Panama Railway Com-

pany, who founded it (1850) for the convenience of their traffic, and derives its more usual name from W. H. Aspinwall, one of their principal shareholders. In spite of the unhealthiness of its situation,—now, indeed, largely diminished,—and the dangerous winds from the north to which it is at some seasons exposed, it has quite superseded the neighboring port of Chagres, and become the centre of a considerable local trade. The banana, especially, is cultivated in the neighborhood and largely exported to New York. The population, composed mainly of Jamaica and Spanish negroes, was stated at 7,000 in 1900. A telegraph line extends from Aspinwall to Kingston in Jamaica.

ASS, The DOMESTIC—*Asinus vulgaris*, Gray—differs chiefly from the horse in its smaller size, in the presence of long hair, forming a tuft, only at the extremity of the tail, and in the absence of wart; on its hind legs. Its fur, usually of a gray color, is characteristically marked with a longitudinal dorsal streak of a darker hue, with a similar streak across the shoulders, but white and black varieties also occur. The ass has been from time immemorial under the dominion of man, and it is doubtful whether the original wild stock is anywhere to be found at the present day,—the specimens that have been described as wild being probably descendants of individuals that have escaped from the domestic state. A wild variety of ass (*asinus lenipus*), found in Abyssinia, has the long acute ears and the bray peculiar to the domestic kinds. It is said also to have cross bands on its legs, a feature occasionally met with in our tame breeds; and this fact has led Darwin and others to conclude that in the wild ass of Abyssinia the original of the domestic animal is to be found; the stripes which occasionally appear on the legs of the latter being regarded as instances of reversion to the ancestral type. The marked aversion of the domestic ass to cross the smallest streamlet, an aversion which it shares with the camel, and the evident delight with which it rolls itself in the dust, seem to point to arid deserts as its original home. The ass has generally been the object of neglect and ill treatment; and attempts have seldom been made to improve the breed by selecting and matching the finer specimens. It has thus gradually sunk into the dull and obstinate creature which we are accustomed to see. Its reputation for stupidity is not, however, of recent origin. The ancient Egyptians hated it, and symbolised an ignorant person by the head and ears, and the Romans thought it a bad omen to meet an ass. In the Middle Ages the Germans of Westphalia made the ass the symbol of St. Thomas, the unbelieving apostle; and the boy who was last to enter the school on St. Thomas' day was called the "Ass Thomas." That the ass possesses qualities, which, if developed by careful selection and humane treatment, would make it a worthy companion of the horse as the servant of man, is seen in the too rare instances in which it has received proper attention. In Southern Europe—especially in Spain, Italy, and Malta,—the ass is carefully bred, and has thus been greatly improved. No less than £200, it is said, is sometimes paid in Spain for a stallion ass. In the State of Kentucky, where mules are in great request as beasts of burden, asses, imported from the south of Europe, are reared with scrupulous care, and with such success, that from an average height of fourteen hands, the Kentuckians have raised these animals to fifteen and even sixteen hands.

ASSAM, a province of British India. Until the beginning of 1874 Assam formed the north-east division of the territories under the Lieutenant-Governor of Bengal. In that year it was erected into a separate administration, presided over by a Chief Commissioner, who

acts directly under the Governor-General of India in council. The district of Cachar was added to the old division of Assam, and now forms part of the Chief Commissioner's jurisdiction. It consists of the upper valleys of the Brahmaputra for a length of about 500 miles from where that river enters the north-eastern frontier of British India. These valleys vary in breadth, but generally occupy a space of about 60 miles between the Himaláys on the north, and the water-shed which separates the Brahmaputra from the river system of Cachar. Assam, therefore, is bounded on the N. by the sub-Himálayan ranges of the Bhutiá, Aká, Daphlá, and Miri tribes; on the E. by the unsurveyed forests and mountains which separate British India from northern Burmah; on the S. by the hills inhabited by the Nágás, Jaintiyas, and Kálsíás, which separate Assam from Silhet; and on the W. by the Gáo hills and Kuch Behar. Assam may be considered, however, either as a natural province or as an artificial political division.

In its former aspect, in which it will be dealt with in this article, it has an area of 52,078 square miles, with a population in 1901 of 6,122,201. It is the outlying province of India to the northeast, so that while the pressure of population in several of the inner divisions of Bengal varies from 500 to 573 persons per square mile, in Assam it is barely 50. Even deducting 12,058 miles of hill country in Lakhimpur and Cachar districts, the pressure of population is only 66 persons per square mile in the more cultivated parts of Assam. Taken as a political division, it is locally administered by a chief commissioner, with his headquarters at Gauhati.

The most important article of commerce produced in Assam is tea. The rice crop covers a very great proportion of the cultivated land, but it is used for local consumption. The tea plantations occupy only a very small area, but they are the one great source of wealth to the province, and the necessities of tea cultivation are the chief stimulants to the development of Assam. The plant was discovered in 1823 by Mr. Robert Bruce, who had proceeded thither on a mercantile exploration. The country, however, then formed part of the Burmese dominions. But war with this monarchy shortly afterwards broke out, and a brother of the first discoverer, happening to be appointed to the command of a division of gun-boats employed in some part of the operations, followed up the pursuit of the subject, and obtained several hundred plants and a considerable quantity of seed. Some specimens were ultimately forwarded to the superintendent of the botanic garden at Calcutta.

The zoology of Assam presents some interesting features. Wild elephants abound and commit many depredations, entering villages in large herds, and consuming everything suitable to their tastes. Many are caught by means of female elephants previously tamed, and trained to decoy males into the snares prepared for subjecting them to captivity. A considerable number are tamed and exported from Assam every year, but the speculation appears to be rather precarious, as it is said about twice the number exported are annually lost in the course of training. Many are killed every year in the forests for the sake of the ivory which they furnish; and the supply must be very great which can afford so many for export and destruction without any perceptible diminution of their number. The rhinoceros is found in the denser parts of the forests, and generally in swampy places. This animal is hunted and killed for its skin and its horn. The skin affords the material for the best shields. The horn is sacred in the eyes of the natives. Contrary to the usual belief, it is stated that, if caught young, the rhinoceros is easily tamed, and becomes strongly attached to his keeper. Tigers

abound, and though many are annually destroyed for the sake of the Government reward, their numbers seem scarcely, if at all, to diminish. Their destruction is sometimes effected by poisoned arrows discharged from an instrument resembling a cross-bow, in which the arrow is first fixed, and a string connected with the trigger is then carried across the path in front of the arrow, and fastened to a peg. The animal thus struck is commonly found dead at the distance of a few yards from the engine prepared for his destruction. Leopards and bears are numerous; and the *Arctonix Collaris* of Cuvier, a small animal somewhat resembling a bear, but having the snout, eyes and tail of a hog, is found. Among the most formidable animals known is the wild buffalo, which is of great size, strength, and fierceness. Many deaths are caused by this animal, and a reward is given for its destruction.

The inhabitants of the entire province number over six millions, of which more than three-fourths are Hindus; half a million are Muhammadans, a few hundred are Christians, and the remainder of a million are hill tribes, professing aboriginal faiths. The native population is so exceedingly sparse that the demand for labor on the tea gardens has given rise to a system of importing coolies from western Bengal. A series of laws regulate the terms of the contract between the planter and the imported laborer, prevent abuses in recruiting coolies among the ignorant peasantry of the west, and provide for their health and comfort during their transit to the distant districts of Assam. Under these Acts 4,988 laborers were imported into the tea districts of Assam (including Cachar) in 1871, the total number of imported laborers employed on the tea plantations at the end of that year being 30,426.

The Assam peasant, living in a half-populated province, and surrounded by surplus land, is indolent, good natured, and, on the whole, prosperous. He raises sufficient food for his wants with very little labor, and, with the exception of a few religious ceremonies, he has no demand made upon him for money, saving the light rental of his fields. Under the peaceful influences of British rule, he has completely lost his ancient warlike instincts, and forgotten his predatory habits. In complexion he is a shade or two fairer than the Bengali. His person is in general short and robust, but devoid of the grace and flexibility of the Hindu. A flat face, with high cheekbones, presents a physiognomy resembling the Chinese, and suggests no idea of beauty. His hair is abundant, black, lank, and coarse, but the beard is scanty, and usually plucked out, which gives him an effeminate appearance. The women form a striking contrast to the men; there is more feminine beauty in them than is commonly seen in the women of Bengal, with a form and feature somewhat approaching the European.

ASSAROTTI, OTTAVIO GIOVANNI BATTISTA, the founder of schools for the education of deaf-mutes in Italy, was born at Genoa in 1753. He received an excellent education; and after qualifying himself for the church, he entered the society of the Pietists, "Scuole Pie," who devoted themselves to the training of the young. His superior learning rendered his services very valuable, and he was appointed to lecture on theology to the students of the order. In 1801 he heard of the Abbe Sicard's experiments in the training of deaf-mutes, and resolved to try something similar in Italy. He began with one pupil, and had by degrees collected a small number round him, when, in 1805, Napoleon, hearing of his endeavors, ordered a convent to be given him for a school house, and funds for supporting twelve scholars to be taken from the convent revenues. This order was scarcely attended to till 1811, when it was renewed, and in the following year Assarotti, with a

considerable number of pupils, took possession of the new school. Here he continued, with the exception of a short interval in 1814, till his death in 1829. A pension, which had been awarded him by the king of Sardinia, he bequeathed to his scholars.

ASSASSINS, a secret military and religious sect formed in Persia and Syria during the 11th century A.D. To understand clearly its nature and tenets, it is necessary to refer to the doctrines of the Ismaelites, of whom it was a branch, and who were themselves an offshoot from the great body of the Shiites. The Shiites, one of the two sects into which the Mahometans had separated, held in opposition to the Sunnites, or orthodox, that the true and only legitimate successor of the Prophet was his son-in-law, Ali. They did not succeed in establishing by force the claims of this family; and, under the dynasties of the Omniade and Abbaside caliphs, they were compelled to keep their opinions secret. The large body of Shiites was further divided into several distinct parties, differing principally with regard to the recognised line of succession from Ali; of these the most powerful was that of the Ismaelites, so called because they held that the Imam descended in an unbroken line from Ali to Ismael, his seventh successor. The adherents of this sect were most widely spread in Persia, and naturally the special object of their opposition was the Abbaside caliphate of Baghdad, but no active steps were taken by them, until under one of the Persian magi, Abdallah-ibn-Maimun Kadah, they had been organised into a secret society, with definite political objects and peculiar religious or philosophical views. Abdallah, like many of his countrymen, was a free-thinker, and he succeeded in establishing among the Ismaelites a faith, or rather a philosophy, wholly opposed to the doctrines of Islam. The fundamental principles of his creed appear to have been—(1.) The rejection of all fixed rules either of religion or morality; all actions were therefore indifferent, only the internal disposition was of any value. (2.) The belief that the Imams of the line of Ismael were at present invisible, and that, consequently, it was the duty of true believers to yield implicit obedience to the viceregents on earth of these secret rulers. (3.) The allegorical interpretation of the Koran, whereby any doctrine might be either defended or rejected.

The first open attempt to put their principles into practice was made by one Ahmed, surnamed Karmath, whence his followers were called Karmathites. After a sanguinary struggle with the caliphs, lasting during many years, this revolt was quelled. But about the same time an adherent of the sect, named Abdallah, a lineal descendant of Ismael, escaped from prison, into which he had been thrown, and, making his way to Egypt, succeeded in placing himself upon the throne of that country. Under the name of Obeid-Allah-Mahdi, he founded the dynasty of the Fatimites, who took their title from their ancestress, the daughter of Mahomet. Ismaelism thus secured a firm footing in the west, and its doctrines were propagated there with great success. At Cairo a grand lodge was formed in which their philosophical principles were perfected, and the process of initiation carried on in its several grades.

The speculative principles of this body were identical with those of the Ismaelites, but their external policy was marked by one peculiar and distinctive feature—the employment of secret assassination against all enemies. In organisation they resembled the western lodge at Cairo. At the head was the supreme ruler, the *Sheikh-al-Jabal*, i.e. Chief, or, as it is commonly translated, *Old Man of the Mountains*. Under him were three *Dai-al-Kirbal*, or, as they may be called, grand priors, who ruled the three provinces over which the *sheikh's* power extended. Next came the body of *Dais*, or priors, who were fully

initiated into all the secret doctrines, and were the emissaries of the faith. Fourth were the *Refiks*, associates or fellows, who were in process of initiation, and who ultimately advanced to the dignity of *dais*. Fifth came the most distinctive class, the *Fedavies*, or *Fedais* (i.e. the devoted ones), who were the guards or assassins proper. These were all young men, and from their ranks were selected the agents for any deed of blood. They were kept uninitiated, and the blindest obedience was exacted from and yielded by them. When the *sheikh* required the services of any of them, the selected *fedais* were intoxicated with the *hashish*, an opiate made from the juice of hemp leaves, and from which the name Assassin is derived. When in this state they were introduced into the splendid gardens of the *sheikh*, and surrounded with every sensual pleasure. Such a foretaste of Paradise, only to be granted by their supreme ruler, made them eager to obey his slightest command; their lives they counted as nothing, and would resign them at a word from him. Finally, the sixth and seventh orders were the *Lasiks*, or novices, and the common people. As for the initiated, they knew the worthlessness of positive religion and morality; they believed in nothing, and scoffed at the practices of the faithful. The Assassins soon began to make their power felt. The death by poison of the Sultan Malik-Shah was ascribed to this dreaded society, and contributed to increase their evil fame. Sultan Sanjar, his successor, made war upon them, but he was soon glad to come to terms with enemies whose operations were invisible, and against whom no precaution seemed available.

During the fourteen years' reign of the second leader, Hassan, the Assassins were frequently unfortunate in the open field, and their castles were taken and plundered; but they acquired a stronghold in Syria, while their numerous murders made them an object of dread to the neighboring princes, and spread abroad their evil renown. A long series of distinguished men perished under the daggers of the *fedais*; even the most sacred dignity was not spared. The Caliph Mostarschen-ali-Mansur was assassinated in his tent, and not long after, the Caliph Rashid suffered a similar fate. Busurg-Omid was succeeded by his son Mahomet I., who, during the long period of 25 years, ruthlessly carried out his predecessor's principles. In his time Massiat became the chief seat of the Syrian branch of the society. Mahomet's abilities were not great, and the affections of the people were drawn towards his son Hassan, a youth of great learning, skilled in all the wisdom of the initiated, and popularly believed to be the promised Imam become visible on earth. The old *sheikh* prevented any attempt at insurrection by slaying 250 of Hassan's adherents, and the son was glad to make submission. When, however, he attained the throne, he began to put his views into effect. On the 17th of the month Ramadan, he assembled the people and disclosed to them the secret doctrines of the initiated; he announced that the doctrines of Islam were now abolished, that the people might give themselves up to feasting and joy, for he was the promised Imam, the Caliph of God upon earth. To substantiate these claims he gave out that he was not the son of Mahomet, but was descended from Nezar, son of the Egyptian Caliph Mostansar, and a lineal descendant of Ismael. After a short reign of four years Hassan was assassinated by his brother-in-law, and his son Mahomet II. succeeded. One of his first acts was to slay his father's murderer, with all his family and relatives; and his long rule, extending over a period of 46 years, was marked by many similar deeds of cruelty. He had to contend with many powerful enemies, especially with the great Atabeg Sultan Nouredin, and his more celebrated suc-

cessor, Jusuf Salaheddin, or Saladin, who had gained possession of Egypt after the death of the last Fatimite caliph, and against whom even secret assassination seemed powerless. During his reign, also, the Syrian branch of the society, under their *dai*, Sinan, made themselves independent, and remained so ever afterwards. It was with this Syrian branch that the Crusaders made acquaintance; and it appears to have been their emissaries who slew Count Raymond of Tripoli and Conrad of Montserrat.

Mahomet III. died from the effects of poison, administered, it is believed, by his son, Jelaeddin Hassan III., who succeeded. He restored the old form of doctrine, — secret principles for the initiated, and Islamism for the people, — and his general piety and orthodoxy procured for him the name of the new Mussulman. During his reign of 12 years no assassinations occurred, and he obtained a high reputation among the neighboring princes. Like his father, he was removed by poison, and his son, Alaeddin Mahomet III., a child of nine years of age, weak in mind and body, was placed on the throne. Under his rule the mild principles of his father were deserted, and a fresh course of assassination entered on. In 1255, after a reign of 30 years, Alaeddin was slain, with the connivance of his son, Rokneddin, the last ruler of the Assassins. In the following year Hulaku, brother of the Tartar, Mangu Khan, invaded the hill country of Persia, took Alamut and many other castles, and captured Rokneddin. He treated him kindly, and, at his own request, sent him under escort to Mangu. On the way, Rokneddin treacherously incited the inhabitants of Kirdkuh to resist the Tartars. This breach of good faith was severely punished by the khan, who ordered Rokneddin to be put to death, and sent a messenger to Hulaku commanding him to slay all his captives. About 12,000 of the Assassins were massacred, and their power in Persia was completely broken.

ASSAULT, in English Law, is defined as "an attempt or offer with force or violence to do corporal hurt to another, as by striking at another with a stick or other weapon, though the party misses his aim." Notwithstanding ancient opinions to the contrary, it is now settled that mere words, be they ever so provoking will not constitute an assault. Coupled with the attempt or threat to inflict corporal injury, there must in all cases be the means of carrying the threat into effect. A *battery* is more than a threat or attempt to injure the person of another; the injury must have been inflicted, but it makes no difference however small it may be, as the law does not "draw the line between degrees of violence," but "totally prohibits the first and lowest stage of it." Every battery includes an assault. A common assault is a misdemeanor, and is punishable by one year's imprisonment with hard labor, but several penalties are provided for the various kinds of aggravated assaults.

ASSAYE, a village of Haidarabad, in the Nizam's dominions, in Southern India. The place is celebrated as the site of a battle fought on the 23d September 1803 between the combined Marhatta forces under Sindhiá and the Rájá of Berar and the British under Major-General Wellesley, afterwards the Duke of Wellington.

ASSAYING. This term is used in metallurgy to denote a chemical operation in which the quantity of one ingredient of a mineral or alloy is determined; it is chiefly used in reference to the precious metals, gold and silver, and it is in this connection that the subject will here be treated of. In the wider acceptance of the term in which it is used amongst practical metallurgists, *assaying* means almost the same thing as the quantita-

tive estimation of one constituent of a compound, when the process adopted is one which has to be frequently repeated in a laboratory, and the results are required for commercial purposes. In this sense we speak not only of the assay of gold and silver, but of other metals, such as lead and copper, of non-metallic elements, such as sulphur and iodine, and even of compounds such as nitre. The operations of assaying were, until recently, chiefly performed by what is called the dry method, but of late years the processes of volumetric analysis have been so largely introduced into the metallurgical laboratory, that the wet method is almost as much used as the dry method. In the process of assaying the precious metals described in the following pages, the reader will have both these terms explained, for gold is assayed in the dry, while silver is assayed in the wet way.

The precious metals, gold and silver, being almost universally used as convenient representatives of value, and as such passing frequently between one country and another, it is of the utmost importance to ascertain, quickly and accurately, the marketable value of any sample of gold or silver bullion. Were these metals invariably used in their pure state, their commercial value would be in direct proportion to their weight, and all that would have to be known would be the actual value of a pound of gold or silver; but the metals exist in commerce in the form of alloys or mixtures containing an indefinite amount of base metal. Gold is generally alloyed with copper and silver, whilst silver is generally alloyed with copper. The problem is, therefore, to ascertain by some ready process, which admits of extreme accuracy as well as moderate rapidity, the exact proportion of pure gold present in an alloy, ore, or mixture containing this metal; and inasmuch as silver is also a precious metal, the assay of gold almost always involves the assay of the silver which accompanies it, for in many cases the amount of silver present may be sufficient to increase the commercial value of the substance under assay. It is very seldom, however, that the copper or the other metal present is in sufficient quantity to be of value, unless, indeed, the substance under assay be a copper ore or pyrites containing only traces of gold. In the case of silver assay, when the base metal is copper, it is generally neglected. It is, however, frequently necessary to examine silver for gold, for, formerly, the methods of parting these two precious metals were by no means so exact as they are now, and on this account old silver frequently contains an amount of gold which it will pay well to extract by modern methods. The principle of assaying gold and silver is very simple theoretically, but in practice great experience is necessary to ensure accuracy, and there is no branch of business which more demands personal and undivided attention.

The only artificial alloys of gold which will be specially noticed here are the standard gold, and alloys of gold with silver or copper used for jewellery. The standard of alloys of gold is expressed in fractions of unity. It is assumed that there are 24 carats in unity, and $\frac{2}{3}$ nds in the carat. Standard gold, in the 24 carats, contains 22 carats of pure or fine gold, as it is called, and two carats of alloying metal, either silver or copper, or a mixture of the two. Standard gold is, therefore, called 22-carat gold. In a similar way articles of jewellery are denominated 12-carat, 16-carat, 18-carat, &c., according to the proportion of fine gold alloyed with the inferior metal. An ordinary assay report of gold expresses the variation from the standard, and not the fine metal contained in it, and it is, therefore, marked as either better or worse than standard. The standard of gold being 22 carats fine and 2 alloy, an ingot of gold found to contain only 21 carats pure gold

would be reported *worse* 1 carat. If it contained 23½ carats, it would then be reported *better* 1½ carat.

The processes by which gold is generally assayed are *cupellation*, when the alloy consists of copper, and *parting*, when the alloy consists of silver. Generally speaking, both operations are necessary. We will describe them as they would be performed in practice. When the standard of the alloy to be examined is not approximately known, a preliminary assay must be made to ascertain the quantity of lead necessary to fuse with the gold alloy. But in most cases this is unnecessary, as, from the circumstances of the case, the standard of the alloy is generally known within sufficiently close limits.

The process of cupellation is briefly as follows:—The gold alloy is fused with a quantity of lead, and a little silver if silver is already present. The resulting alloy, which is called the *lead button*, is then submitted to fusion on a very porous support, made of bone-ash, and called a *cupel*. The fusion being effected in a current of air, the lead oxidises. The heat is sufficient to keep the resulting oxide of lead fused, and the porous cupel has the property of absorbing melted oxide of lead without taking up any of the metallic globule, exactly in the same way that blotting-paper will absorb water whilst it will not touch a globule of mercury. The heat being continued, and the current of air always passing over the surface of the melted lead button, and the oxide of lead or *litharge* being sucked up by the cupel as fast as it is formed, the metallic globule rapidly diminishes in size until at last all the lead has been got rid of. Now, if this were the only action, little would have been gained, for we should simply have put lead into the gold alloy, and then taken it out again; but another action goes on whilst the lead is oxidising in the current of air. Other metals, except the silver and gold, also oxidise, and are carried by the metal litharge into the cupel. If the lead is therefore rightly proportioned to the standard of alloy, the resulting button will consist of only gold and silver, and these are separated by the operation of *parting*, which consists in boiling the alloy (after rolling it to a thin plate) in strong nitric acid, which dissolves the silver and leaves the gold as a coherent sponge. To effect this parting properly, the proportion of silver to gold should be as 3 to 1. The operation by which the alloy is brought to this standard is termed *quartation* or *inquartation*, and consists in fusing the alloys in a cupel with lead and the quantity of fine silver or fine gold necessary to bring it to the desired composition.

The amount of lead having been determined, the alloy is wrapped up in a known quantity (say one-half of that required for its purification), formed into a case somewhat resembling a thimble, great care being taken to make the joints firm and close so that no gold shall escape. The requisite quantity of silver is added at the same time. When a number of assays are made at the same time, they are arranged, enveloped in their lead cases, on a board divided into compartments corresponding in number and position with the cupels into which they are intended to be charged. As the assayer generally makes two or more trials of the same piece, so that greater accuracy may be secured, it is his practice to give one assay a side place in the muffle, and the second a middle one, in order to check any irregularity in the result. When a sufficient number of assays are weighed and arranged upon the board in the manner referred to, and the furnace as well as the cupels raised to the necessary point of heat, the charging tongs are then taken, and the rest of the lead and silver apportioned to each assay placed individually upon the cupels, beginning at the back of the muffle. The lead added in this case is not flattened, but is a piece of known weight—various sizes of which, as well as cases, are kept in stock

by the assayer. The lead so placed in the furnace rapidly melts, and becomes covered with a grey oxide, but soon after appears fluid and bright. At this point the assays are added by means of a pair of tongs, great care being taken that no part overhangs or touches the edge of the cupel. The assays are thus drawn into the mass of molten lead, and any particles of gold are in this manner prevented from adhering to the sides of the cupels in charging, sufficient despatch being used to obviate the fusion of the assay in its transition. The assays being charged in order on their respective cupels, and the furnace previously filled with fuel, the door of the muffle is partly closed, and the progress of the cupellation watched. Too much air must not enter, or the muffle will be chilled and the progress retarded, whilst if too little enters the operation will be too slow.

At first dense fumes will be observed to rise from the melted metal, indicating the oxidation and subsequent volatilisation of the lead. These after continuing some time are followed by the appearance of small luminous points on the surface, which increase in size and brilliancy as the operation progresses. Then a minute stream of red fused oxide of lead is seen to flow from the top of the metal globule and circulate round, when it is carried down and absorbed by the cupel. This is caused by the oxidation of the lead by the air, which at the same time oxidises the other metals, except silver, which accompanies the gold. As the cupellation advances the fumes gradually lessen in density till they disappear altogether. The melted button at this stage is observed to become more convex and round, and as the last vestiges of the lead and alloy are being carried off, it assumes a cloudy appearance on the surface, charging to large bright points of the fused oxide, till at length it is nearly freed from all impurity. At this point the gold-silver alloy displays some singular and beautiful characteristics. Deprived of all the base alloy save the last minute portion that tarnished its lustre, it has become bright and pure, and finally it gives forth from its surface iridescent circulating bands of light, which indicate the successful completion of the operation. The globules, after being cooled, are removed from the cupels with a pair of pincers and carefully cleaned. They are then placed in their compartments and weighed with the greatest nicety. Finally, they are submitted to the operation of *parting*. This is effected by boiling with strong nitric acid, which dissolves the silver and leaves the gold as a sponge. The gold-silver globule is first passed through a flattening mill, and reduced to long thin strips, which are annealed and then rolled up into a corkscrew spiral, so that the acid may penetrate between each fold. The spirals are now transferred in order to small platinum cups arranged on a frame, so that they can be simultaneously lowered into and removed from the nitric acid. They are kept in the hot acid for the requisite time, then washed, and the residual gold sponge, which possesses considerable coherence, and retains the shape of the original spiral, is carefully dried and finally weighed with the greatest possible accuracy.

We shall now proceed to describe briefly the process of silver assay. The cupellation process does not differ except in details from that of gold,—the outline already given will, therefore, be a sufficient description. Like gold, silver occurs in two classes of combinations,—*mineralised*, as in *red silver ore*, *chloride of silver*, *argentiferous galena*, &c., or as *metallic silver* and its alloys. In metallurgical establishments, where silver occurs in small proportions with metallic sulphides, such as those of lead or copper, the process of cupellation is generally adopted, not only for quantitative estimation of the amount of silver present in the ore, but also for

its extraction on the large scale. In the assay of silver bullion however, the process of cupellation is now almost entirely superseded by a volumetric process, devised by the distinguished French chemist, Gay-Lussac, by whose influence it was introduced in the Paris mint. The process consists in determining the fineness of silver bullion by the quantity of a standard solution of common salt necessary to precipitate fully and exactly the silver contained in a known weight of alloy.

ASSEGAI, a slender spear of hard wood, tipped with iron, used in battle by the South African tribes, notably the warlike Zulus. Some assegais are held in the hand and used as spears for thrusting; a shorter kind are hurled from the hand as missiles.

ASSELYN, HANS, a celebrated Dutch painter, was born at Antwerp in 1610, and died in Amsterdam in 1660.

ASSEMANI, the name of a Syrian Maronite family of famous orientalists.

(1.) **JOSEPH SIMON**, a Maronite of Mount Lebanon, was born in 1687. When very young he was sent to the Maronite College in Rome, and was transferred thence to the Vatican Library. In 1717 he was sent to Egypt and Syria to search for valuable MSS., and returned with about 150 very choice ones. The success of this expedition induced the Pope to send him again to the East in 1735, and he returned with a still more valuable collection. He died in 1768.

(2.) **JOSEPH ALOYSIUS**, brother of Joseph Simon, and professor of Oriental languages at Rome. He was born in 1710 and died in 1782.

(3.) **STEPHEN EPHODIUS**, nephew of Joseph Simon and Joseph Aloysius, was the chief assistant of his uncle Joseph Simon in his work in the Vatican Library. He was born in 1707 and died in 1782.

(4.) **SIMON**, grandnephew of Joseph Simon, was born at Tripoli in 1752, and was professor of Oriental languages in Padua. He died in 1821.

ASSEMBLY, GENERAL, in Scotland, Ireland, and the United States, denotes the highest court of the Presbyterian church. It differs from the Anglican Convocation at once in its constitution and in its powers, representing as it does both the lay and the clerical elements in the church, and possessing legislative and judicial authority in all matters purely ecclesiastical. The General Assembly of the Presbyterian Church in the United States meets annually in May, but has no stated place of meeting. There is also a General Assembly of the Southern Presbyterian Church, and of the United and Cumberland Presbyterians; while the Reformed Presbyterian Church of the United States, like the United Presbyterian Church in Scotland, calls its supreme court the synod.

ASSEN, a town of the Netherlands, capital of the province of Drenthe, containing 6,836 inhabitants.

ASSENS, a town of Denmark, on the west coast of Fühnen, the ordinary port for the traffic between that island and Schleswig. Population about 5,500.

ASSER, JOHN, or **ASSERIUS MENEVENIS**, was born in Pembrokeshire, and educated in the monastery of St. David's by the Archbishop Asserius, who, according to Leland, was his kinsman. Here he became a monk, and by his assiduous application soon acquired universal fame as a person of great abilities and profound learning. King Alfred, always a munificent patron of genius, about the year 880 sent for him to court, and made him his preceptor and companion. As a reward for his services, the king appointed him abbot of two or three different monasteries, and at last promoted him to the episcopal see of Sherborne, where he died in the year 910.

ASSESSMENT is a valuation of property, income,

or profits, for the purpose of taxation, made by authorized persons according to their discretion, as opposed to a sum determined by law; or the fixing of the amount of damages, as by a jury.

ASSESSORS in England are persons sometimes associated with judicial functionaries, to assist in the argument and procedure before them and to advise their judgments. In the United States, the term is only employed in the common sense of persons elected or appointed to determine the value of property liable to assessment.

ASSETS, a technical English law word, derived through the old Norman phraseology from the same source as the French *assez*, enough, and signifying the property of a debtor available for the satisfaction of his creditors. Thus the property of a bankrupt is termed his assets, and is the fund out of which his liabilities must be paid. When the person dies, the goods which come to executors or administrators are called assets *personal*; the lands descending to the heir, are assets *real*.

ASSIDEANS, is a transcription of the Hebrew *chashidim*, *pious ones*, a word frequent in the Psalms. In the first book of Maccabees the name of Assideans appears as the designation of a society of men zealous for the law, and closely connected with the scribes.

ASSIGNATS. After appropriating to national purposes the land belonging to the church, the French National Assembly, instead of bringing it into the market at a time of insecurity, when its value was depreciated, issued bonds on the security of it, which were called *assignats*, as representing land *assigned* to the holder. This paper-money consisted chiefly of notes for 100 francs each, though many of them were for lower sums; and the first issue in 1790 amounted to 400,000,000 francs. The system relieved the Government; "the assignats saved the revolution" for the time being. The facility of this plan of providing Government income led to its being repeatedly had recourse to, as the property of wealthy emigrés was confiscated, till the amount rose to the enormous sum of 45,578,000,000 francs, besides great numbers of forged notes. At last the value of assignats sank almost to *nil*. In March, 1796, a louis d'or (24 francs) bought 7,200 francs in assignats. After this they were withdrawn from the currency, and redeemed at a thirtieth of their nominal value, by "territorial mandates," a new kind of paper money, which enabled the holder at once to take possession of public lands at the estimated value, while assignats could only be offered at a sale. The *mandates* also soon fell to a seventieth of their nominal value, and were returned to Government in payment of taxes or of land. The system came to an end early in 1797.

ASSIGNMENT, ASSIGNATION, ASSIGNEE, are terms which, as derivatives of the verb *assign*, are of frequent technical use in the law of the different parts of the United States. To assign is to make over, and the term is generally used to express a transference by writing in contradistinction to a transference by actual delivery.

ASSINIBOIA, a Canadian district or territory within the limits of the Northwest Territories. It lies to the west of Manitoba, is bounded on the south by the United States frontier, west (at 111° W.) by Alberta Territory, north (52° N.) by the new Territory of Saskatchewan. It has an area of about 90,000 square miles. Pop. (1901), 67,305.

ASSINIBOINE, a river of British North America, rising in 51° 40' N. latitude and 105° E. longitude. At Winnipeg it joins the Red River, which discharges its waters into Lake Winnipeg.

ASSISI (ancient *Assisium*), a city of Italy in the province of Perugia. It contains about 6,000 inhabi

tants, depending chiefly for subsistence on the devotees, who, to the number of many thousands, make annual pilgrimages to the church which contains the tomb and bears the name of St. Francis, the founder of the Franciscan order, who was born at Assisi in 1182.

ASSIZE, or ASSISE (from *assideo*, to sit together; Old French *assire*, to set, *assis*, seated), literally signifies a "session," but is an equivocal noun meaning sometimes a jury, sometimes the sittings of a court, and sometimes the ordinances of a court or assembly.

ASSOCIATION OF IDEAS, or MENTAL ASSOCIATION, is a general name used in psychology to express the conditions under which representations arise in consciousness, and also is the name of a principle of explanation put forward by an important school of thinkers to account generally for the facts of mental life.

ASSOUAN (also *Esuan*; the ancient *Syene*) is the southernmost city of Egypt proper, on the right bank of the Nile, and beside the first or lowest cataract. Population, about 4,000.

ASSUAY, formerly the most southern department of Ecuador, in South America. It is now broken up into the two provinces of Cuenca and Loxa. Cuenca, Loxa, Jaca and Borga were its principal towns. Its chief productions were cinchona bark and silver.

ASSUMPSIT. In the United States *assumpsit* is the most common form of action. It is defined to be an action for the recovery of damages for the breach of a parol or simple contract; but in reality it is the form of action generally used for the recovery of any debt, or for the recovery of money in the hands of the defendant which in justice and equity belongs to the plaintiff. The essential is that there should be a privity of contract between both parties either expressed or implied. *Assumpsit* has in most of the older States by statute superseded all the common law forms of action. It is based upon the general equitable idea that one ought to do what he has assumed or promised or undertaken to do, and being equitable in its nature, takes the place of all other civil actions in those States in which the difference between equity and law has been abolished in practice, and but one form of civil action is recognized by statute.

ASSUMPTION, a festival of the Christian church, observed on the 15th of August, in honor of the miraculous ascent of the Virgin Mary into heaven. It rests upon a purely traditional account of the ascent, first recorded by Gregory of Tours. Its present place in the calendar was fixed early in the eighth century. The Roman and Greek churches celebrate this festival.

ASSYRIA. The two great empires which grew up on the banks of the Tigris and Euphrates can be separated as little historically as geographically. It is proposed, therefore, to treat both under the heading BABYLONIA. From the beginning their history is closely intertwined; and the power of the one is a measure of the weakness of the other. This interdependence of Assyrian and Babylonian history was recognized by ancient writers, and has been confirmed by modern discovery. But whereas Assyria takes the first place in the classical accounts of the exclusion of Babylonia, the decipherment of the inscriptions has proved that the converse was really the case, and that, with the exception of some six or seven centuries, Assyria might be described as a province or dependency of Babylon.

AST, GEORGE ANTHONY FREDERICK, a German philosopher and philologist of considerable distinction, was born at Gotha in 1778. He was educated at the gymnasium of that town, and afterward at the university of Jena. He distinguished himself as a student, and in 1802 he became a privat-docent in his alma

mater. Three years later he was appointed professor of classical literature in the University of Landshut, where he remained until 1826, when that institution was transferred to Munich. In this latter city he spent the rest of his life. He died December 30, 1841.

ASTARTE (ASHTAROTH) was the chief goddess of the Phœnicians in Zidon, where was a temple in her honor. In Tyre also she had a temple, and from thence her worship was transplanted to Carthage. At what time it was introduced among the Jews is not known.

ASTELL, MARY, an English authoress, born at Newcastle-upon-Tyne in 1668. She was instructed by her uncle, a clergyman, in Latin and French, logic, mathematics and natural philosophy. In her twentieth year she went to London, where she continued her studies. Her efforts were especially directed to the mental improvement of her sex.

ASTER, a genus of composite plants (*Compositæ*), found largely in North America, and scattered sparingly over Asia, Europe, and South America. They are usually perennial, and their flowers are arranged in numerous heads (*capitula*). Asters receive the name of Michaelmas and Christmas daisies, because they have heads like daisies, and, when the weather is mild, they flower up to this period of the year.

ASTERISK (Gr. a little star), a sign symbol (*) used in writing and printing, as a reference to a note at the bottom or on the margin of the page. The asterisk often marks the omission of words or sentences, or it distinguishes words as conjectural or obscure, or it may be used merely as a typographical mark for any use.

ASTERIUS, of Cappadocia, was a heathen sophist and teacher of rhetoric in Galatia. About the year 300 he was converted to Christianity, and became the disciple of Lucian, the founder of the school of Antioch.

ASTERIUS, Bishop of Amasia, in Pontus, in the end of the 4th and in the beginning of the 5th century. His fame rests chiefly on his *Homilies*, which were greatly esteemed in the Eastern Church.

ASTEROIDS, the name given to a large number of small planets, which revolve round the sun in orbits lying between those of Mars and Jupiter. They are all extremely small, their brightness seldom exceeding that of stars of the eighth magnitude; their paths, which cross and recross each other, extend over a belt about 250,000,000 miles in breadth; and the eccentricities of the orbits of many of them, and the inclinations of their planes to the plane of the ecliptic, are much greater than those of the larger planets. All the asteroids have been discovered during the present century. (See ASTRONOMY.)

ASTHMA, a disorder of respiration characterised by severe paroxysms of difficult breathing, usually followed by a period of complete relief, with recurrence of the attacks at more or less frequent intervals. The term is often incorrectly employed in reference to states of embarrassed respiration, which are plainly due to permanent organic disease within the chest, and which have none of the distinctive characters of true asthma. The onset of an attack of asthma is usually sudden, although there may exist certain premonitory symptoms which warn the sufferer of its approach, such as a feeling of discomfort, drowsiness, irritability, and depression of spirits. The period when the asthmatic paroxysm comes on is generally during the night, or rather in the early hours of morning. The patient then awakes in a state of great anxiety and alarm, with a sense of weight and tightness across the chest, which he feels himself unable to expand with freedom. Respiration is performed with great difficulty, and is accompanied with wheezing noises. His distress rapidly increases, and he can no

longer retain the recumbent position, but gets up, and sits or stands with his shoulders raised, his head thrown back, and his whole body heaving with his desperate efforts to breathe. His countenance is pale or livid, and wet with perspiration, while his extremities are cold; his pulse is rapid and weak, and frequently irregular or intermitting. All his clothing must be loose about him; he cannot bear to be touched, and the very presence of others around him seems to aggravate his distress. His one desire is to breathe fresh air; and he will place himself by an open window and sit for hours in the middle of the night, unmindful of the exposure. His appearance is alarming in the extreme, and it often seems as if each breath would be his last. The paroxysm, after continuing for a variable length of time, often extending over many hours, begins to abate, the breathing becomes easier, and the subsidence of the attack is frequently marked by the occurrence of coughing with expectoration. When the expectoration is abundant, the asthma is called *humid*, but where there is a little or none it is termed *dry*. After the cessation of the attack the patient appears to be and feels comparatively well. In cases, however, of long standing the subject of asthma comes to bear permanent evidence of its effects. He is easily put out of breath on exertion and he requires to lie with his head elevated, circumstances to be ascribed to organic changes in the chest, which oft-recurring attacks of asthma are liable to induce. The asthmatic paroxysms, although occasionally periodic, do not generally observe any regularity in their return. They may recur each successive night for several days, or there may be no return for many weeks or months, this being to a large extent dependent on a renewal of the exciting cause. Asthma is much more common in men than in women. It may be developed at any age, but is most frequently observed in early and middle life.

The treatment of asthma consists in the employment of remedies to allay the paroxysms, and in the adoption of measures likely to prevent their recurrence. During the attack the patient should be placed in as favorable circumstances for breathing as practicable. He usually selects the position easiest for himself. Abundance of air should be admitted to the apartment, and he should be interfered with as little as possible. Morphine should be given in $\frac{1}{8}$ -grain doses every hour or two till relieved, or chloroform or sulphuric ether inhaled during the paroxysm. When the premonitory symptoms are felt, smoking stramonium (or Jameston weeds) will aid in warding off the attack, while extract of hyoscyamus (henbane), in small doses, should be taken. Extract of gelsemium (white jessamine) is also useful, together (in some cases) with ipecacuanha, in dose large enough to produce slight nausea. Tobacco fumes are also useful in some cases to produce a relaxation of the pectoral muscles and afford relief. If morphine is administered, no more than three-quarters of a grain should be given, unless by a physician.

ASTI, a large and well-built town of Italy, in the province of Alessandria (Piedmont), situated on the left bank of the Tanaro. It is the see of a bishop, the chief town of a *circondario*, and a station on the Turin and Alessandria railway. Population, about 19,000.

ASTOR, JOHN JACOB, an enterprising American merchant, founder of the Astor Library at New York, was born at the village of Walldorf near Heidelberg, on the 17th July 1763. His father was a peasant, and his early years were spent in the common labors of the farm. At sixteen he joined an elder brother, a musical instrument maker, in London, and at twenty sailed for the United States. On the voyage he became acquainted with a fur-trader, by whose advice he devoted himself to the same business. By his energy, industry, and

sound judgment he gradually enlarged his schemes, did business in all the fur markets of the world, and amassed an enormous fortune,—the largest up to that time made by any American. He devoted many years to carrying out a project for organising the fur trade from the Lakes to the Pacific Ocean, and thence by way of the Sandwich Islands to China and India. In 1811 he founded at the mouth of the Columbia river a settlement, named after him Astoria, which was intended to serve as the central depôt; but in the following year the settlement was taken and occupied by the English. The settlement is now, however, in the United States, in Clatsop County, Ore. A series of disasters frustrated the gigantic scheme. Astor made vast additions to his wealth by investments in land in New York city. He made many charitable bequests by his will, and among them a gift of \$50,000 to the poor of his native village in Germany. But the deed by which he will be chiefly remembered was the foundation and endowment by his will of the Astor Library at New York, for which he bequeathed the sum of \$400,000. The building, erected in Lafayette Place (1850-53), is in the Byzantine style of architecture. Washington Irving was appointed first president, and the formation and arrangement of the library was entrusted to Mr. J. G. Cogswell. The building has since been enlarged at the cost of the eldest son of the founder. Mr. Astor spent the last twenty-five years of his life in retirement, and died at New York, March 29, 1848.

ASTORGA (the ancient *Asturica Augusta*), a city of Spain, in the province of Leon, in a plain near the Tuento.

ASTORGA, EMANUELE D', a distinguished musical composer, was born at Palermo about 1680. In 1703 he entered the service of the duke of Parma, and while at his court produced many compositions. The duke, suspecting that an attachment existed between his daughter and Astorga, dismissed the musician, but gave him a letter of recommendation to Leopold of Austria. The emperor received him kindly, and at his court Astorga produced his pastoral opera of *Daphne*. In 1705, on the death of his patron, he visited Florence, and then London, where he wrote his *Stabat Mater*, the best of all his works. He resided in Spain, and died in Bohemia. The date of his death is quite uncertain.

ASTORIA, the capital of Clatsop County, Ore., is handsomely situated on the south bank of the Columbia river, ten miles from the Pacific Ocean, and forty miles from Portland. The city is a port of entry for the Columbia river country, and the headquarters for the salmon-fishing industry on the North Pacific coast. It contains two banks, two daily and five weekly papers, and many stores and places of public resort. The city also contains half a dozen churches, a new custom-house, city hall, high school and academies, hotels, private residences, etc. The canning of salmon is an important line of business carried on here, there being no less than twenty establishments thus engaged, giving employment to nearly 4,000 hands. The manufactures embrace lumber and lumber products, iron, fish-oil, and other commodities. The city is lighted by gas, and a street railway system is in operation. A large steamship and passenger traffic is conducted also. Pop. (1900), 8,381.

ASTRABAD, or ASTERABAD, a small province of Persia, bounded on the N. by the Caspian Sea and the desert, on the S. by the Elburz Mountains, W. by Mazanderan, and E. by the river Gorgan. The country, although mountainous, and interspersed with dense forests, in which it is scarcely possible to travel, possesses beautiful and fertile valleys, producing rice, wheat, and other grains in abundance, or spread out in a boundless expanse of verdure, the pasturage of

numerous flocks and herds. The province is famous for furnishing a supply of mactlocks for the king's body-guard. It is the ancient Hyrcania, and the native country of the Kajers, a Turkish tribe, of whom the king is the head, and on whom he considers he can rely in times of danger.

ASTRABAD, or ASTERABAD, the capital of the above province, is situated near the mouth of the River Gorgan, which flows into the Caspian, and at the head of a sheltered bay, convenient for shipping. It is a straggling town, about $3\frac{1}{2}$ miles in circuit, and picturesque in appearance, from the buildings which intermingle with trees and gardens. The population is estimated to be about 5,600.

ASTRAKHAN, a government of European Russia, bounded on the southeast by the Caspian Sea, northeast by Orenburg, north by Saratov and west by the country of the Don Cossacks, and southwest by the government of the Caucasus. It has an area of about 84,948 square miles, divided into two nearly equal parts by the Volga, and consists chiefly of sandy deserts interspersed with saline lakes; but in the delta and on the banks of the rivers, grapes and other fruits of southern climates are raised. The population in 1898 was estimated at 994,775, comprising Russians, Tartars, Georgians, Armenians, Persians, Hindus, etc., who engage in the rearing of horses, cattle and sheep, and also in fishing for sturgeon, which forms the principal source of the wealth of the government. The vicissitudes of climate are great; with a mean annual temperature of 48° Fahr., the summer averages 70°, and the winter 15° Fahr. The government is divided into four districts: Astrakhan, Krasnoi-Yar, Zenotaïesk and Chemyi-Var. Its capital, Astrakhan, is the only place of much importance.

ASTRAKHAN, the capital of the above government, is situated on a small island in the Volga, about 30 miles above the influx of that river into the Caspian. It is a large, rambling wood-built city, "dusty in summer, windy in autumn, frozen-up in winter, and knee-deep in mud in spring." Population estimated, in the year 1898, 112,880.

ASTRÆA, daughter of Zeus and Themis, or of Astræus and Eos (Aurora), was the last of all the goddesses to leave the earth when the golden age had passed away. She took her place in heaven as the constellation Virgo in the zodiac. Astræa is also the name of one of the planetoids.

ASTRAL SPIRITS. The star (Gr. *astron*) and fire worship of the Eastern religions rested on the doctrine that every heavenly body is animated by a pervading spirit, forming, as it were, its soul. In the demonology of Christendom in the middle ages, astral spirits are conceived of sometimes as fallen angels, sometimes as souls of departed men, sometimes as spirits originating in fire, and hovering between heaven, earth and hell, without belonging to any one of these provinces.

ASTRINGENTS (Lat. *ad*, to, and *stringo*, I bind), medicines employed for the purpose of contracting the animal fibers and canals, so as to check fluxes, hemorrhage and diarrhoea. The drugs most commonly used as astringents are alum, catechu, oakgalls, rhatany-root, etc.

ASTROLABE (from two Greek words signifying to take the stars), the name given by the Greeks to any circular instrument for observing the stars, circular rings, as arranged in the Armillary sphere, were used for this purpose.

ASTROLOGY, the so-called science by which various nations, in various ways, have attempted to assign to the material heavens a moral influence over the earth and its inhabitants. For long ages astronomy and astrology

were identified. Isidore of Seville is the first to distinguish between the two; nor did astronomy wholly rid itself of astrology, till, with the system of Copernicus, the conviction that the earth itself is one of the heavenly bodies was finally established. Even at the present day a few may be found who, from a superstitious reverence for the past, or the spirit of contradiction, pride themselves on their adherence to the belief in stellar influences. It is no longer necessary to protest against an error which is dead and buried, but let us pause a moment and ask what we mean by an error. With Spinoza we would say that erroneous ideas consist in the fancies and opinions which the senses suggest to the mind in a confused, imperfect, and ill-ordered manner. To this sort of knowledge Spinoza gives the name of vague experience. This vague experience is further complicated by the employment of signs, which flatter the fancy, and of which we form ideas like those which the objects themselves presented at first to our imagination. If to these two elements—vague experience and the misleading use of signs—we add the instinctive impulse which led primitive man to imagine a universe created according to the analogy of his mind, we have before us the three causes which led the Indians, Greeks, Egyptians, Chaldeans, and their Alexandrian disciples, the Arabs and their followers, during the middle ages and the Renaissance, to lend themselves to the illusions of astrology, and by a preposterous philosophy to deduce the laws of nature from a theory of morals.

Astrology is generally divided into natural astrology, the science which predicts the motions of heavenly bodies and eclipses of sun and moon, and judicial astrology, which studies the influence of constellations on the destiny of men and empires. But it is obvious that both of these branches presuppose an advanced stage of astronomical knowledge, and a state of society not necessarily better, but more complex than that in which the first worshipers of the heavens were placed. It follows, then, that both natural astrology and judicial astrology must have been preceded by a science less learned in heavenly motions, and at the same time more moral in the best sense of the word. Astronomers have taken very little pains to trace their favorite science to its source by help of the copious astrological commentaries in which the earliest observers embodied their theories of the heavens. Philosophers, with the single exception of Schopenhauer, have shown the same indifference. The Egyptians peopled the constellations of the zodiac with genii; the ram (*Arnum*) was lord of the head; the bull (*Apis*), of the neck and shoulders; the twins (Hercules and Apollo), of the arms and hands; and lastly, to the fishes were assigned the feet. The Persians, again, ascribed to the empty-rean generally the influence over the citadel of the body—the head. Dionysius, the Areopagite, indulging his religious proclivities, established hierarchies of genii in the constellations. The Assyrians were led by their form of government to place thirty-six conciliar-gods in the twelve signs of the zodiac, and to the interpreter-gods, whose province it was to inspect and survey the various divisions of the heavens, they allotted the wandering planets. Whenever a new discovery was made in medicine or science, the province of the god-stars was immediately enlarged; thus the Egyptians, observing the symmetry of the human body, and connecting this with the dualism of human faculties, at once made the sun (*Ra*) the lord of the forehead, the moon mistress of the brain, and Mercury of the tongue; but to Saturn they assigned only the left eye; to Jupiter was given the right; Mars had the right nostril, Venus the left. Meanwhile, in another quarter of the globe a religion was growing up—a religion of mild

anthropomorphism, wholly removed from Oriental transcendentalism. It is in Greece, whose deities had been gradually molded and drilled so as to serve as types of men and manners, that we must look for the key of astrology. Jupiter, the embodiment of authority, and Cynos, or Saturn, the impersonation of malignant opposition to authority, are the two most prominent figures of ancient mythology. Venus was placed below Mars; that is, the sensual passion was subjected to martial ardor.

We may now describe the ordinary proceedings of an astrologer. The zodiac was first arranged in much the same fashion as the cards in the game of Tarots. The four ages of man had each three houses in the zodiac. Each of this triple series was composed of a cardinal, a succeeding, and a declining or cadent house. Disastrous signs predominated over auspicious. For kings and nobles these signs were modified, but they took care to preserve a copy of the horoscope to be modified as circumstances required. Pascal remarks:—"They say that eclipses portend misfortunes, because misfortunes are common, so that, as some ill-chance often happens, they are often right, whereas if they said that they portended good fortune, they would be generally wrong. They only assign good fortune to rare conjunctions of the stars, and this is how their predictions rarely fail." Those ages during which astrologers were dominant by the terror they inspired, and sometimes by the martyrdom they endured when their predictions were either too true or too false, were in truth the saddest in the world's history. Faith, to borrow their own language, was banished to Virgo, and rarely shed her influence on men. Cardan, for instance, hated Luther, and so changed his birthday in order to give him an unfavorable horoscope. In Cardan's times, as in those of Augustus, it was a common practice for men to conceal the day and hour of their birth, till, like Augustus, they found a complaisant astrologer. But, as a general rule, astrologers did not give themselves the trouble of reading the stars, they contended themselves with telling fortunes by faces. They practiced chiromancy, and relied on afterward drawing a horoscope to suit. As physiognomists their talent was undoubted, and we may call Vanini as a witness that there is no need to mount to the housetop to cast a nativity. "Yes," he says, "I can read his face; by his hair and his forehead it is easy to guess that the sun at his birth was in the sign of Libra and near Venus. Nay, his complexion shows that Venus touches Libra. By the rules of astrology he could not lie." No doubt, by the rules of chiromancy, a calm forehead, clustering locks, a clear and sanguine complexion, are signs of sincerity. If we combine Apollo and Venus, *i. e.*, manliness and tenderness, the product is sincerity.

In conclusion, we shall give a few salient facts concerning the astrologers and their predictions, remarkable either for their fulfillment, or for the ruin and confusion they brought upon their authors. We may begin with one taken from Bacon's *Essay of Prophecies*:—"When I was in France, I heard from one Dr. Pena that the queen mother, who was given to curious arts, caused the king her husband's nativité to be calculated, under a false name; and the astrologer gave a judgment, that he should be killed in a duel; at which the queene laughed, thinking her husband to be above challenges and duels; but he was slaine, upon a course at tilt, the splinters of the staffe of Montgomery going in at his bever." A favorite topic of the astrologers of all countries has been the immediate end of the world. As early as 1186 the earth had escaped one threatened cataclysm of the astrologers. This did not prevent Stoffer from predicting a universal deluge for the year

1524—a year, as it turned out, distinguished for drought. His aspect of the heavens told him that in that year three planets would meet in the aqueous sign of Pisces. The prediction was believed far and wide, and President Aurial, at Toulouse, built himself a Noah's ark—a curious realization, in fact, of Chaucer's merry invention in the *Miller's Tale*. In China any false prediction of the astrologers was punished with death.

ASTRONOMY is the science which deals with the distribution, motions, and characteristics of the heavenly bodies. Astronomy may probably be regarded as the most ancient of the sciences. Even the least civilized races must have recognized the regular vicissitudes of day and night (and, therefore, the diurnal course of the sun), while before long the variety and succession of the seasons would be noted, and their cause—the oblique annual motion of the same luminary—would be recognized. The moon in the sun's absence is so conspicuous and so useful that her motions, her various phases, and her regular disappearance and return after equal intervals of time, must have been watched in the earliest times with attention and interest. The occurrence of eclipses and other unusual phenomena would stimulate closer scrutiny. The spectacle of the starry heavens, seemingly unchangeable, save for the motions of a few wandering orbs along a certain zone of the star-sphere, early suggested an association between the fates of men and nations and these emblems of unchanging destiny on the one hand and of the changeable lot of mankind on the other.

But though mankind were probably first impelled by motives of mere curiosity to observe the courses of the stars, no great length of time could have elapsed ere they perceived that the regular and uniform revolutions of the heavens might be rendered subservient to their own wants and conveniences. By the help of the stars the shepherd, during the night, could count the hours, the traveler track his course through the uniform wastes of the desert, and the mariner guide his bark over the ocean; the husbandman, also, learned to regulate his labors by the appearance of certain constellations, which gave him warning of the approaching seasons. The indications derived from the simple observation of such phenomena were doubtless extremely vague; but as civilization advanced, the necessity of determining accurately the length of the solar year and of the lunar month, in order to regulate the calendar and the religious festivals, led to the accumulation and comparison of different observations, whereby errors were gradually diminished, and the foundations laid of a more perfect science. Astronomy thus presenting so many objects of curiosity and interest, and having so many practical uses, could not fail to be one of the sciences first cultivated by mankind. Its origin is, consequently, hid amidst the obscurity of remote ages, and is, in fact, coeval with the earliest development of the human intellect.

According to the unanimous testimony of the Greek historians, the earliest traces of astronomical science are to be met with among the Chaldeans and Egyptians. The Egyptians were in ancient times the rivals of the Chaldeans in the cultivation of astronomy; and although they have left behind them still fewer monuments of their labors, they have obtained, through the exaggerated statements of the Greeks, even a greater reputation. The Greeks acknowledge themselves indebted to the Egyptians for their science and civilization; but regarding themselves likewise as descendants of that ancient people, they indulged their vain-glory in magnifying the accounts of the antiquity and knowledge of their supposed ancestors.

The Phœnicians are also generally enumerated among

the nations who cultivated astronomy at a very early period, though it does not appear, from any facts mentioned by ancient authors, that they devoted themselves specially to the observation of the heavens, or made any discoveries relative to the motions of the planets.

In China, astronomy has been cultivated from the remotest ages, and has always been considered a science indispensably necessary to the civil government of the state. The Chinese boast of a series of eclipses, recorded in the annals of the nation, extending over a period of 3,858 years, all of which, they affirm, were not only carefully observed, but were calculated and figured previous to their occurrence.

The astronomy of the Indians forms one of the most curious problems which the history of science presents, and one which, notwithstanding much discussion, still continues involved in great uncertainty.

The origin of astronomy in Greece, as in other early nations, ascends beyond the period of authentic history. The true foundations of Grecian science were laid by Thales, who was born at Miletus 640 years before our era. He formed a sect which has been distinguished by the title of the "Ionian School." Thales was succeeded by Anaximander, to whom also is attributed a knowledge of the sphere and of the zodiac. Anaximenes succeeded Anaximander in the Ionian school, and maintained nearly the same doctrines.

While the Ionian sect was so successfully employed in cultivating and propagating a knowledge of nature in Greece, another, still more celebrated, was founded in Italy by Pythagoras. Pythagoras is said to have acquired in Egypt the knowledge of the obliquity of the ecliptic, and of the identity of the morning and evening stars. What he chiefly deserves to be commemorated for in the history of astronomy, is his philosophical doctrine regarding the motion of the earth. He taught publicly that the earth is placed at the center of the universe; but among his chosen disciples he propagated the doctrine that the sun occupies the center of the planetary world, and that the earth is a planet revolving round the sun. This system, which still retains his name, being called the old or Pythagorean system of the universe, is that which was revived by Copernicus. Philolaus of Crotona, a disciple of Pythagoras, embraced the doctrine of his master with regard to the revolution of the earth about the sun. He supposed the sun to be a disk of glass which reflects the light of the universe. He made the lunar month consist of $29\frac{1}{2}$ days, the lunar year of 354 days, and the solar year of $365\frac{1}{2}$ days. Nicetas of Syracuse seems to have been the first who openly taught the Pythagorean system of the universe.

Although Plato can hardly be cited as an astronomer, yet the progress of the science was accelerated by means of the lights struck out by his penetrating genius. He seems to have had just notions of the causes of eclipses; and he imagined that the celestial bodies originally moved in straight lines, but that gravity altered their directions, and compelled them to move in curves. He proposed to astronomers the problem of representing the courses of the stars and planets by circular and regular motions. Geometry was assiduously cultivated in the school of Plato; and on this account he claims a distinguished place among the promoters of true astronomy.

Astronomy is also under some obligations to Aristotle. In a treatise which he composed on this science, he recorded a number of observations which he had made; and, among others, mentions an occultation of Mars by the moon, and another of a star in the constellation Gemini by the planet Jupiter. As such phenomena are of rare occurrence, their observation proves that he had

paid considerable attention to the planetary motions.

The first astronomers of the Alexandrian school were Aristillus and Timocharis, who flourished under the first Ptolemy, about 300 years B.C. The chief object of their labors was the determination of the relative positions of the principal stars of the zodiac instead of merely announcing their risings and settings, as had been the practice of the Orientals and the ancient Greeks. The observations of these two astronomers conducted Hipparchus to the important discovery of the precession of the equinoxes, and served as the basis of the theory which Ptolemy, some centuries afterward, gave of that phenomenon.

About this time the science of astronomy was enriched by the discoveries of some of the distinguished geometers whose labors have so greatly extended the glory of the Alexandrian school. Euclid, the celebrated author of the *Elements*, lived in the reign of the first Ptolemy. He composed a book on the sphere, which probably served as a model for future works of the same kind, and was the first who treated in a geometrical manner the phenomena of the different inclinations of the sphere.

Astronomy, which had as yet only consisted of a knowledge of isolated facts, acquired a systematic form, and almost a new existence, from the genius of Hipparchus, perhaps the greatest of all ancient philosophers in the sciences which are not purely speculative. This illustrious founder of astronomical science was born at Nicæa in Bithynia, and observed at Rhodes. After the death of Hipparchus nearly three centuries elapsed before any successor arose worthy of the name. During this long period astronomy made no essential advancement.

Ptolemy was born at Ptolemais in Egypt, and flourished at Alexandria about the 130th year of our era, under the reigns of Hadrian and Antoninus. This illustrious ornament of the Alexandrian school is entitled by his own discoveries to the high rank among astronomers which has universally been assigned to him; but the most signal service which he conferred on science was the collection and arrangement of the ancient observations. Ptolemy has been called The Prince of Astronomers,—a title which may perhaps be justified by the universal and long-continued prevalence of his system, but to which he has no claim from the number or value of his own observations. After a laborious and minute examination of the *Almagest*, Delambre doubts whether anything is contained in that great work, beyond the author's own statement, from which it can be decisively inferred that Ptolemy ever observed at all. He, indeed, frequently makes mention of observations made by himself; but his solar tables, rate of the precession, eclipses, determination of the moon's motion and parallax, and above all his catalogue of stars, render it impossible to doubt that the greater part of the results which he has given as observations are merely computed from the tables of Hipparchus.

The most celebrated of the Arabian astronomers was Albategni, or Muhammed Ben Geber Al-Batani, so-called from Batan, a city of Mesopotamia, where he was born about 850. He was a prince of Syria, and resided at Rakka in Mesopotamia, but many of his observations were made at Antioch. Having studied the *Syntaxis* of Ptolemy, and made himself acquainted with the methods practiced by the Greek astronomers, he began to observe, and soon found that the places assigned to many of the stars in Ptolemy's tables were considerably different from their actual situations, in consequence of the error which the latter had committed, with regard to the precession of the equinoxes.

Ulugh Begh, a Tartar prince, and grandson of the great Tamerlane, not only encouraged the study of astronomy, but was himself a diligent and successful observer. At Samarcand, the capital of his dominions, he established an academy of astronomers, and caused the most magnificent instruments to be constructed for their use. By means of a gnomon 180 feet in height, he determined the obliquity of the ecliptic to be $23^{\circ} 30' 20''$, the precession of the equinoxes at 1° in 70 years, and obtained elements for the construction of tables which have been found to be scarcely inferior in accuracy to those of Tycho Brahe. The ancient astronomy had produced only one catalogue of the fixed stars,—that of Hipparchus. Ulugh Begh has the honor of having formed a second, after an interval of sixteen centuries. After the death of Ulugh Begh, astronomy received no farther accessions in the East. But the seeds of knowledge had now begun to take root in a more propitious soil, and Europe, destined to carry the development of the human energies to its fullest extent, began to awake from the lethargy in which it had continued during so many ages.

We come now to the period of the overthrow of the Ptolemaic system and the total renovation of the science of astronomy, which was due to the labors of Copernicus. The system which is associated with the name of Copernicus is now so familiar to every one, that it is almost unnecessary to describe it. The heaven, composed of stars perfectly at rest, occupies the remotest bounds of space, then the orbit of Saturn, next Jupiter, Mars, the Earth (accompanied by its moon), Venus, Mercury, and, lastly, the Sun immovable at the center. By this arrangement the stations and retrogradations of the planets became simple mathematical corollaries, following from the differences of the radii of their orbits and their unequal motions. The diurnal rotation of the earth explained more simply and rationally the apparent daily revolution of the heavens; and the precession of the equinoxes was referred to a small variation in the inclination of the earth's axis to the plane of the ecliptic. But the simplicity of the system, and its consequent probability, were the only arguments which Copernicus was able to bring forward in proof of its reality. The motion of the earth can, indeed, never be made an object of ocular demonstration; but after Richer's discovery of the diminution of gravity toward the equator, it was impossible to doubt longer of the existence of its rotary motion; and when Roemer had measured the velocity of light, and Bradley observed the phenomena of aberration, the evidences of its annual revolution were rendered equally convincing. For the events of his life see COPERNICUS.

Tycho Brahe stands next in chronological order on the roll of those who have contributed to the progress of astronomy. As an indefatigable and skillful observer, he is justly considered as far superior to any astronomer who had preceded him since the revival of the science in Europe. His ample fortune gave him the means of procuring the best instruments which the age could produce; and by his ingenuity and persevering application, he was admirably qualified to employ them to the best advantage. For an account of his life see BRAHE, TYCHO.

The great mass of accurate observations accumulated by Tycho furnished the materials out of which his disciple Kepler may be said to have constructed the edifice of the universe. The observations of the Danish astronomer had furnished the latter with the means of establishing with certainty the truth or inaccuracy of the various hypotheses which he successively imagined; and the diligence with which he labored in comparing

and calculating these observations during twenty years, was finally rewarded by some of the most important discoveries which had yet been made in astronomy. (See Kepler's laws *supra*.)

Contemporary with Kepler was the illustrious Galileo whose discoveries, being of a more popular nature, and far more striking and intelligible to the generality of mankind, had a much greater immediate effect on the opinions of the age, and in hastening the revolution which was soon about to change the whole face of physics and astronomy. While residing at Venice, he heard it reported that Metius, a Dutch optician, had discovered a certain combination of lenses, by means of which distant objects were approximated to the sight. This vague and scanty intelligence sufficed to excite the curiosity of Galileo, who immediately set about inquiring into the means whereby such an effect could be produced. His researches were attended with prompt success, and on the following day he had a telescope which magnified about three times. It was formed by the combination of two lenses, a plano-convex and plano-concave, fitted in a leaden tube. In a second trial he obtained one which magnified seven or eight times; and subsequent essays enabled him to increase the magnifying power to thirty-two times. On directing his telescope to the moon, he perceived numerous inequalities on her surface, the diversified appearances of which led him to conclude almost with certainty that the moon is an opaque body similar to the earth, and reflecting the light of the sun unequally, in consequence of her superficial asperities. The planet Venus exhibited phases perfectly similar to those of the moon.

Science is indebted to Galileo for two other discoveries of a different kind, less brilliant perhaps, but of far greater importance than those which we have yet enumerated. These are the isochronism of the vibrations of the pendulum, and the law of the acceleration of falling bodies. His telescopic discoveries could not have remained long unknown; in fact, with the exception of those of the phases of Venus, and of the triple form of Saturn, they were all fiercely disputed, even during his own lifetime. It is now universally admitted that he was the first who discovered the satellites of Jupiter, and the spots of the sun; but the very circumstance of other claimants to these discoveries having arisen, proves that they were within the reach of ordinary observers. For an account of his eventful life see GALILEO.

While astronomy was making these rapid advances in the hands of Kepler and Galileo, an event occurred in Scotland which contributed, though less directly, no less powerfully, to the acceleration of its progress. This was the invention of logarithms by Lord Napier, baron of Merchiston. "An admirable artifice," says Laplace, "which by reducing to a few days the labor of many months, doubles the life of the astronomer, and spares him the errors and disgust inseparable from long calculations—an invention of which the human mind has the more reason to be proud, inasmuch as it was derived exclusively from its own resources."

Few individuals have rendered more important services to science than Huyghens. His improvement of the telescope and his application of the pendulum to clocks were valuable additions to the machinery of astronomical investigation. By means of his telescopes he discovered that the extraordinary appearance exhibited by Saturn was occasioned by a ring surrounding the body of the planet, and inclined to the ecliptic in an angle which he estimated at 21° . He lived to witness the discovery of four more satellites belonging to the same planet. (See HUYGHENS.)

The application of telescopes and micrometers to

graduated instruments forms an important epoch in the history of astronomy. The Royal Observatory of Paris was completed in 1670, and its direction intrusted to Dominic Cassini, who enriched astronomy with a great number of valuable observations and new discoveries. He determined the motions of Jupiter's satellites from observations of their eclipses, and constructed tables of them, which were found to be remarkably exact. He observed that the ring of Saturn is double, and discovered four of the satellites of that planet. He also determined the rotation of Jupiter and Mars, and made a number of observations on Venus with the same view. He observed the zodiacal light, and made a near approximation to the parallax of the sun. We also owe to him the first table of refractions calculated on correct principles, and a complete theory of the libration of the moon.

There is no period in the history of mankind so distinguished by great and important discoveries, or so remarkable for the rapid development of the human intellect, as the seventeenth century. We have already noticed the invention of the pendulum, and its application to regulate the motion of timekeepers; the invention of the telescope, bringing within the range of vision the phenomena of new worlds; of logarithms, by which computations are so much abridged; and of the mechanical contrivances for measuring minute angles in the heavens. The same century witnessed the application of algebra to geometry, the discovery of the laws of the planetary motions, the infinitesimal calculus, the acceleration of falling bodies, the sublime theory of central forces, and the great principle of gravitation which connects the celestial orbs, and regulates the motions which it had been the business of the astronomer to observe since the earliest ages of the world. The service which the discovery of these primary laws rendered to the progress of astronomy can scarcely be exaggerated.

By the discovery of the law of gravitation, Newton laid the foundations of physical astronomy; and by the consequences which he deduced from that law, he proceeded far in the erection of the superstructure. While physical astronomy was undergoing a complete revolution in the hands of Newton, the practical part was receiving great improvement from Flamsteed, the first astronomer royal, who conducted the Greenwich Observatory. This celebrated institution, from which so many important discoveries have emanated, was erected under the reign of Charles II, in 1675. Flamsteed was appointed to it in 1676, and continued with indefatigable zeal to discharge the duties of the office during the long period of thirty-three years.

Flamsteed was succeeded in the observatory by Halley, who held a prominent place among English astronomers. From early youth he applied himself with ardor to the study of mathematics and astronomy; and having procured a few instruments, he began to make observations, by which he was led to remark the inaccuracy of the tables of Jupiter and Saturn. In his nineteenth year he published a direct and geometrical method of finding the eccentricities and aphelia of the orbits of the planets, and in the year following he undertook a voyage to St. Helena, with a view to form a catalogue of the stars in the southern hemisphere. In 1720 Halley was appointed to succeed Flamsteed in the Royal Observatory.

The discoveries of Bradley, who succeeded Halley as astronomer royal, form a memorable epoch in the history of the science. It was reserved to him to give the theoretical explanation of a singular motion of the polar star which had been first observed by Picard, who had remarked that the inequality was annual, and

amounted to about forty seconds, but had been unable to refer it to any law.

While England was witnessing the brilliant discoveries of Bradley, France produced a number of excellent astronomers, by whose successful labors every department of the science was signally promoted. Among these Lacaille is distinguished, both by his scientific zeal and the importance of his observations.

The question of the figure of the earth furnished ample materials for the practical as well as the speculative astronomer during the eighteenth century. The results of the measurement of the meridian by Cassini were at variance with the theories of Newton and Huyghens; and the Academy of Sciences resolved on making a decisive experiment by the actual measurement of the lengths of two degrees, one at the equator, and another at as high a latitude as could be reached. In the year 1735, three astronomers—Godin, Bouguer, and La Condamine—were commissioned by the French Government to accomplish the first of these objects in Peru; and the year following, Maupertuis, Clairaut, Camus, and Lemonnier went to Lapland to execute the second under the polar circle.

Maskelyne, the second English astronomer royal after Bradley, was appointed, in 1761, to observe the transit of Venus at the island of St. Helena. In the year 1765 he was appointed astronomer royal, and soon after recommended to the Board of Longitude the general adoption in the navy of the lunar method of finding the longitude, and proposed that tables for facilitating that method should be calculated and published in the *Nautical Almanac*.

Sir William Herschel, born in Hanover in 1738, has rendered his name immortal by the discovery of a new planet beyond the orbit of Saturn, and thereby doubling the ancient boundaries of the solar system. His observations on nebulae and double stars opened up a new field of research, boundless in extent, and interesting by reason of the variety of the objects it presents to the attention of the observer. The extraordinary activity with which he pursued his favorite occupation is attested by sixty-seven memoirs communicated by him from time to time to the Royal Society.

In the year 1764, the Academy of Sciences of Paris, which had so successfully promoted the great efforts that had already been made to perfect the theory of attraction, proposed for the subject of a prize the theory of the libration of the moon. Lagrange had the honor of carrying off the prize; but although he treated the subject in a manner altogether new, and with extraordinary analytical skill, he did not on this occasion arrive at a complete solution of the problem. In 1766 he obtained another prize for a theory of Jupiter's satellites. Of all the grand discoveries by which the name of Lagrange has been immortalized, the most remarkable is that of the invariability of the mean distances of the planets from the sun.

On account of the brilliant discoveries and important labors which we have just briefly noticed, Lagrange must be considered as one of the most successful of those illustrious men who have undertaken to perfect the theory of Newton, and pursue the principle of gravitation to its remotest consequences. But the value of his services to science is not limited to his discoveries in physical astronomy, great and numerous as these were. After Euler, he had contributed more than any other to increase the power and extend the applications of the calculus, and thereby to arm future inquirers with an instrument of greater efficiency, by means of which they may push their conquests into new and unexplored fields of discovery.

With the name of Lagrange is associated that of La-

place, their rival labors dividing the admiration of the scientific world during half a century. Like Newton and Lagrange, Laplace raised himself at an early age to the very highest rank in science. Before completing his twenty-fourth year he had signalized himself by the important discovery of the invariability of the mean distances of the planets from the sun, on an hypothesis restricted, indeed, but which, as we have already mentioned, was afterward generalized by Lagrange. About the same time he was admitted into the Academy of Sciences, and thenceforward devoted himself to the development of the laws which regulate the system of the world, and to the composition of a series of memoirs on the most important subjects connected with astronomy and analysis. His researches embraced the whole theory of gravitation, and he had the high honor of perfecting what had been left incomplete by his predecessors.

In the other departments of astronomy, also, numerous questions still remain to be discussed, the solution of which will occupy and reward the future labors of astronomers, and in which much progress has been made during the present century, by means of the powerful instruments now employed at the great observatories of every civilized country, and the improved methods of analysis brought to bear upon the results of observation. The curious phenomena of double and multiple stars, some of which are found to form connected systems of bodies revolving about one another, or a common center of motion—the variable stars—the proper motions of the stars—the translation of the solar system in space—the progressive condensation of nebulae—are subjects still in a great measure new; for it is only of late years that observers have begun to direct the requisite attention toward them, or indeed have been in possession of instruments of sufficient power and delicacy to observe and measure the minute changes which take place beyond the boundaries of our own system. The discoveries in astronomy during the present century have been so brilliant and numerous, and the progress in every department is so rapid, and involves so many details, that it would be impossible to give here a detailed account of that progress.

PART II.—THEORETICAL ASTRONOMY.

When we look at the heavens on a clear night, we perceive a concave hemisphere on which are strewn multitudes of bright points. As we watch these hour after hour, we find that they are carried round precisely as though they were fixed on the interior surface of a spherical shell turning on a fixed axis. New groups are seen to rise above the eastern horizon, while those above the western horizon descend and finally disappear. Turning toward the south, we see that the groups of stars which pass above the horizon somewhat to the east of the south attain but a slight elevation when at their highest in the south, and then descending set as far to the west of the south point as they had risen to the east of it. Turning to the north, we see that there are groups of stars which remain visible the whole night, wheeling around a fixed point, and describing circles of greater or less magnitude according as they are at a greater or less distance from that point. Supposing our standpoint to be in or near London, the point thus remaining fixed is due north, and about $51\frac{1}{2}^\circ$ above the horizon—therefore, about $38\frac{1}{2}^\circ$ from the point directly overhead. If the heavens be observed night after night, similar phenomena are seen; and we recognize the uniformity of the motion of the (imaginary) star-sphere about its (imaginary) axis; for in any assigned interval, on any night in the year, the star-sphere turns by the same amount. It is soon found that the rate of turning is such that a complete rotation

is effected in the course of about one day. But before many days have passed we find that this uniform turning motion does not correspond exactly to our common day. For though on several successive nights the stars may appear to be nearly in the same situation with respect to the horizon at any assigned hour, yet before long (or even in twenty-four hours if exact observation be made) it is found that the stars occupy the same position, *not* at the same hour on successive nights, but about four minutes earlier night after night. Thus, in the course of about fifteen days, the star-sphere has gained one hour's rotation; in about thirty days, two hours' rotation, and so on; until in the course of a year the star-sphere has gained a complete rotation, and the stars have the same apparent position at any assigned hour of the night as they had when the observations were commenced.

Limiting our attention for the present to the stars—though already, in speaking of the common day, we have in fact referred to the sun—the idea suggested by the observed phenomena is that the apparent star-sphere revolves around the earth precisely as it seems to do, turning about an axis, with a perfectly uniform motion, completing one rotation in twenty-four hours, less about four minutes. The natural steps for determining whether this really is the case, are—first, a series of careful observations at one fixed station; and, secondly, a study of the effects produced by change of station.

The altitude of the star, being in this case measured from the north, point N, is the supplement of the arc obtained by thus adding the north declination to the meridional altitude of the equator.

We see then that the declination of a star (or its north polar distance) determines the altitude of its culminating point. To determine the time at which the star culminates it is necessary that another co-ordinate should be known.

As we measure the declination from the equator, or in other words, determine the altitude of culmination by a reference to the equator, it is manifestly convenient to measure the time of a star's culmination by referring it to the time of culmination of some selected point on the equator. This is the course adopted by astronomers. The point selected for the purpose is one of the two points in which a great circle on the celestial sphere, called the ecliptic, cuts the equator. This point is called the first point of Aries, and is indicated by the sign T. At present it is only necessary to note that this point is in reality affected by a slow motion on the star-sphere, due to the fact that the axis on which the star-sphere apparently turns undergoes a slow change of position within the star-sphere itself, so that the equator is not really a fixed circle on the heavens. But for the purpose we have at present in view this slow change may be neglected; and we assume that the observer on earth has the equator as a fixed circle from which to measure the declination of stars, and that he also has a fixed point on the equator by which to time the culmination of each star. Knowing the declination of a star, he knows at what altitude it will culminate as viewed from the fixed station at which thus far we have supposed him to be placed. Let him now note the exact moment at which the first point of Aries culminates, and let him observe the precise interval in time between that moment and the moment when a star of known declination culminates; this interval is constant, and thereafter he will always know not only at what altitude that star will culminate, but at what time after the culmination of the point T. The interval in time between the culmination of T and the culmination of a given star is called the *right ascension* of the star. It may be measured, indeed, as an arc, viz.—

as the arc on the equator intercepted between T and that point in which a meridian circle through the star intersects the equator, the arc being measured in the direction opposite to that in which the star-sphere rotates. But the right ascension is more conveniently and now almost always measured in time.

The time measurement employed is the rotation of the star-sphere itself. The interval in time between the successive culminations of T is called a *sidereal day*. It is divided into 24 hours (numbered 0, 1, 2, 3 . . . to 24), each hour into 60 minutes, each minute into 60 seconds. If we have a clock showing 24 hours, and so rated as always to show 0 hour 0 min. 0 sec., when T is at its culmination, that clock will always show true sidereal time. Such a clock would gain nearly 4 min. a day as compared with an ordinary clock; but we need not at present dwell upon this point. Now the right ascension (or, as it is written, the R.A.) is indicated in sidereal time, and therefore corresponds to the time shown by the sidereal clock when that star is culminating. Thus, if a star's right ascension is 3 h. 2 m. 6 s., then when the sidereal clock shows time 3 h. 2 m. 6 s., that star is culminating. Whether it be day or night the astronomer knows this certainly, that is, if his sidereal clock is trustworthy.

It will be manifest that an observer at a fixed station, as we have thus far supposed our observer to be, requires to have the means of determining—(1) the moment at which a star culminates (or is on the meridian), and (2) the star's altitude when at its culmination. We have seen how the movement of the star-sphere determines the *cardinal points* of the horizon. Suppose now a telescope or pointer, so set as to turn upon a horizontal axis lying exactly east and west. We see that when the telescope is rotated on this axis, the line of sight, or the optical axis of the telescope, sweeps round in the plane of the meridian. It can be directed due south toward S, or to $\mathcal{A}$ E (the culminating point of the celestial equator), or to s , a star on the meridian, or to the zenith Z, or to the pole P, or to the north point N—in fine, to any point on the celestial meridian. Now, if any contrivance be adopted to enable the observer to note the exact moment of sidereal time when a star crosses the middle of the field of view of such a telescope, then the right ascension of that star is known at once. Such an instrument, if devised simply or mainly for noting the moment of culmination, is called a *transit instrument*. If arranged with circles so that angles can be determined, the instrument is called a *transit circle*. An arrangement, now little used, in which a meridional circle bearing a telescope works against a fixed plane surface or wall (necessarily standing in a north-and-south position) is called a *mural circle*. The point to be specially noted in this plan is that, from observations of the star-sphere, we determine the cardinal points; and then the position of any star in the heavens can be determined by an instrument contrived so as to swing in the plane of the meridian. This done, a clock, carefully rated to show sidereal time, enables the astronomer at a fixed station to turn his transit instrument to the point of culmination of a star at the exact time when the star will culminate, and at the true place of such culmination.

But now let us suppose our observer to travel in a north-and-south direction, in order to determine what change, if any, will be produced by such voyage. The first effect noticed is that the pole of the heavens rises higher and higher above the northern horizon, as he travels farther and farther north, whereas the pole sinks lower and lower down toward the northern horizon the farther the observer travels toward the south. Close observation shows that the change of the pole's eleva-

tion is either exactly proportional to the observer's change of place in a north-and-south direction, or so nearly so that any discrepancy will require the closest and most exact scrutiny. The observer also notices that the stars retain their relative positions absolutely unaltered, but that new stars are seen in the south when he travels southward. This shows that the star-sphere is either truly a spherical enclosure—all the stars lying at the same distance—or else that the distances of the stars are so enormous that the displacement of the observer on the earth, even by several hundred miles, is as nothing by comparison. The uniform change in the pole's elevation cannot be explained, however, by merely supposing the stars very far away compared with terrestrial distances. It is manifest that we can only explain the observed facts by assuming that the course pursued by the supposed observer is not a straight line, but curved, and that it is curved uniformly, since the polar elevation changes uniformly when the observer travels at a uniform rate. It follows, therefore, that the path of the observer must be part of a circular arc. In other words, to an observer traveling uniformly along an arc toward the south, the angular elevation of the pole would diminish uniformly, as it is observed to do, if (1) the arc is circular, and (2) the pole of the heavens so far from the observer that lines drawn to it are appreciably parallel. Similarly the uniform increase of the polar elevation, to an observer traveling northward along the arc is explained.

Continuing this voyage southward, the observer finds the pole continues to sink, until at length the north pole of the heavens is on the horizon due north. All the phenomena of celestial rotation continue unchanged, except that toward the south many new stars have come into view. Moreover, the south pole of the heavens has now risen to the horizon, and lies due south. If the observer were now to retrace his course, he would, of course, find the north pole of the heavens rising uniformly again. But if instead of this he continue his journey southward, he finds the south pole of the heavens rising uniformly.

We see that journeys taken in a north-and-south direction lead to apparent changes of the dome of the heavens, only explicable on the assumption that the path traversed is a circular arc, or nearly so. It is clear also that the radius of this circular arc is determinable if the observer notes how much the elevation of the pole is changed for any given distance traversed by him in a north-and-south direction. Suppose for instance that in traveling he finds the elevation of the pole diminished by 7° , and that he has traveled about 480 miles, then (as already shown) he knows that $ab = ab = \text{change in polar elevation} = \text{an arc of } 7^\circ \text{ of the circumference of the circle along which he is traveling.}$

Hence the whole circumference = $\frac{360}{7} \times 480 \text{ miles} = 24,686 \text{ miles;}$

whence the diameter of the circle = (roughly) $\frac{7}{22} \times 24,686 = 7855 \text{ miles.}$

This is not the true diameter of the earth's globe, being supposed to be the result of only a rough observation; but the method serves sufficiently to show how in very early times astronomers obtained a measure of the earth. For from whatever station the observer starts on north-and-south journeys, the same uniform elevation or depression of the visible pole as he travels toward or from it is observed; and the inference, therefore, is that the earth is a globe, since all the lines drawn on it in a north-and-south direction are circular arcs of equal radius. The points where the poles are both on the horizon, mark the

place of the *terrestrial equator*; and the points on the earth (which have never yet been reached), where the north and south celestial poles are respectively vertical, are the *terrestrial or geographical poles*.

Thus far we have considered only journeys made along a north-and-south course. Journeys pursued due east or due west, that is, always toward the point of the horizon which is 90° to the right or to the left of the north point, show equally that the observer is traveling on the surface of a globe, though they produce no apparent change either in the elevation of the pole or in the position of the points at which known stars rise, culminate, and set. We have seen that the observer who remains always at one station can determine the absolute time when any given star will culminate. Let us suppose that when journeying eastward or westward he can carry with him his sidereal time-measure, and that this continues throughout to show the true sidereal time of his original station. Then if he is traveling eastward he will find that any given star, instead of culminating at the time noted for that star as observed at his original station, will culminate earlier. The right ascension of the star will remain unchanged. On the contrary, if the observer travels westward from his original station, he finds that each star culminates later. Moreover, the observer finds that the amount of change in point of time corresponds to the distance he travels. Then the observer finds that the change in the time of a star's culmination corresponds exactly, to the length of arc traversed by him round the circle on the assumption that a complete circumference of this circle corresponds to 24 hours of sidereal time. This corresponds with the result of the former series of observations in showing that the earth is a globe, suspended, as it were, within the star-sphere; and that either the star-sphere turns uniformly around this terrestrial globe from east to west once in 24 sidereal hours, or else the terrestrial globe turns uniformly round its axis once in 24 sidereal hours from west to east.

The earth has now been shown to be a globe within the star-sphere, and whether the earth rotates within the star-sphere, or the star-sphere rotates round the earth, or both the earth and the star-sphere rotate, it is known that, *relatively to the earth*, the star-sphere rotates from east to west once in 24 sidereal hours. This rotation, whether apparent or real, takes place without any appreciable change in the relative position of the fixed stars. And the law of rotation having once been ascertained, it follows that the time of culmination of any star, and the position of the star at the time, are known, inasmuch that a telescope or pointer can be directed to the place of the star at the moment of culmination with perfect exactness. Moreover, a star can be followed by an instrument properly devised, in such sort that a pointer shall continue directed upon the star all through the 24 sidereal hours.

We perceive, then, that if any celestial object is visible, whether by day or night, then by simply directing toward it a telescope we can ascertain in what part of the stellar heavens that celestial object lies. And if the object is moving upon the stellar heavens—or, in other words, it is other than one of these fixed stars with which we have hitherto been dealing—then by turning a telescope toward it from time to time we can determine its apparent path among the stars. So that in the case of the sun, which is never seen in company with the stars simply because his light, by illuminating our air, veils the stars from view, we can nevertheless ascertain exactly along what path on the star-sphere he seems to move, at what rate, and whether the rate is uniform or variable.

But before we examine the results of observations carried out for this purpose, it will be well to consider a circumstance affecting observations made in this manner. We refer to the refractive action of the earth's atmosphere, by which the apparent positions of the celestial bodies are to some degree affected. This is the proper place to mention the effects of refraction, because there can be little doubt that it was during observations of the sun that the refractive action of the atmosphere was first discovered. However, in explaining this action, reference will be made to the stars as heretofore, in order that the inquiry into the sun's apparent motions may be referred solely to the sphere of the fixed stars.

By a well-known optical law, a ray of light in passing obliquely from one medium to another of greater density is refracted or bent toward the normal to their common surface. We may regard our atmosphere as composed of an infinity of concentric spherical shells, whose densities increase the nearer they are to the earth's surface. When a ray of light from a star enters the atmosphere, therefore, it is inflected toward the earth, and the inflection is increased by every successive stratum of the atmosphere through which the light passes. The decrease of the density of the atmosphere, from the surface of the earth upward, follows the law of continuity, or takes place by insensible degrees; so that the luminous ray, in traversing the atmosphere, enters at every instant into a denser medium, and is therefore continually brought nearer and nearer to the vertical direction. Hence the true path of the ray is curvilinear, and concave toward the earth. This is equivalent to the supposition that the thickness of the different concentric strata of uniform density is infinitely small, and that the light, as it successively penetrates each, deviates from its former path by an infinitely small angle, which may be considered as the differential of the refraction, the total amount of which will therefore be obtained by integration. It is evident that the amount of the refraction is greater in proportion as the observed star is nearer to the horizon; for in this case the luminous rays strike the tangent planes of the atmospherical strata more obliquely, and have besides to traverse a greater extent of atmosphere before they arrive at the eye of the observer. On determining by experiment the refraction at every altitude from zero to 90° , tables of *Refraction* may be constructed, which will furnish the means of discovering the law of its diminution; but as such a process would be exceedingly tedious, and likewise apt to lead to erroneous results on account of the inevitable errors of observation, it is found more convenient to assume some hypothesis for a basis of calculation, and to verify the results which it leads to by comparing them with observation. In regard to media, which may be said to be permanent—such, for instance, as water and glass—the determination of the refraction is not attended with great difficulty; but the circumstances are greatly altered when we come to make experiments on the atmosphere. In this case the difficulty arises from the incessant changes which the atmosphere is undergoing relatively to its refractive power—changes which it is impossible for the observer fully to appreciate, inasmuch as he can only determine its physical state within a short distance of the earth, while that of the upper strata remains wholly unknown to him. The refractive power of the atmosphere is affected by its density and temperature. The effects of the humidity are insensible; for the most accurate experiments seem to prove that the watery vapors diminish the density of the air in the same ratio as their refractive power is greater. It is therefore only necessary, even in delicate experiments, to have regard

to the state of the barometer and thermometer at the time the observation is made.

It may be explained that the refraction of the rays of light in traversing the earth's atmosphere is the cause of *Twilight*, which sensibly lengthens the duration of the day, and prevents a sudden transition from light to darkness on the disappearance of the sun. When the sun is more than 33° below the horizon, the refraction is not powerful enough to bring his rays sufficiently near the earth to reach our eyes; they pass over our heads, and are irregularly reflected by the molecules of the atmosphere. By this means a portion of the celestial vault is enlightened, while the sun is invisible. This illumination of the upper regions is called the twilight. It commences as soon as objects can be distinguished before sunrise, and terminates when they cease to be visible after the sun has set. The time, however, at which the twilight commences and terminates cannot be assigned with any degree of precision. It is generally supposed to be limited by the depression of the sun 18° below the horizon. Lacaille found the limit in the torrid zone to be between 16° and 17° . According to Lemonnier, it varies in France between 17° and 21° . The duration of the twilight will evidently be longer or shorter, according as the inclination of the sun's motion to the horizon is more or less oblique.

The apparent enlargement of the sun and moon near the horizon is an optical illusion, connected in some measure with the atmosphere, of which various explanations have been given since the time of Ptolemy. According to the ordinary laws of vision, the celestial bodies, particularly the moon, which is nearest to the earth, ought to appear largest in the meridian, because their distance is then less than when they are near the horizon; yet daily experience proves that the contrary takes place. The mean apparent diameter of the moon, at her greatest height, is $31'$ in round numbers, but in the horizon she seems to the eye two or three times larger. The commonly received explanation of this phenomenon was first given by Descartes, and after him by Dr. Wallis, James Gregory, Malebranche, Huyghens, and others, and may be stated as follows:—The opinion which we form of the magnitude of a distant body does not depend exclusively on the visual angle under which it appears, but also on its distance; and we judge of the distance by a comparison with other bodies. When the moon is near the zenith there is no interposing object with which we can compare her, the matter of the atmosphere being scarcely visible. Deceived by the absence of intermediate objects, we suppose her to be very near. On the other hand we are used to observe a large extent of land lying between us and objects near the horizon, at the extremity of which the sky begins to appear; we therefore suppose the sky, with all the objects which are visible in it, to be at a great distance. The illusion is also greatly aided by the comparative feebleness of the light of the moon in the horizon, which renders us in a manner sensible of the interposition of the atmosphere. Hence the moon, though seen under nearly the same angle, alternately appears very large and very small. Desaguliers illustrated the doctrine of the horizontal moon by the supposition of our imagining the visible heavens to be only a small portion of a spherical surface, in which case the moon, at different altitudes, will appear to be at different distances, and will therefore seem to vary in magnitude.

Correction being made for refraction, the true position of the sun on the star-sphere can be ascertained day after day; and thus his apparent motions, as we have said, can be determined.

The result of such observations is to show that in a

period of about 365 days the sun traverses a great circle of the star-sphere inclined to the equator. This period is called a *year*, and is familiar to all as the period in which the sun's varying positions, alternately north and south of the equator, bring about the circuit of the seasons. For we have already seen that a star to the north of the equator is above the horizon more than half the sidereal day, and at its meridian culmination has an altitude exceeding that of the south point of the equator. When the sun is north of the equator he has a daily arc like that of a star similarly placed, so that day lasts longer than night, and at mid-day the sun pours his heat more directly on the earth than if he were on the equator. In like manner it is shown that, when the sun is south of the equator, night lasts longer than day, and the sun at mid-day has a smaller altitude than if he were on the equator. The result of constant experience shows, that the sun's declination reaches its maximum on the south side of the equator about December 22, when it amounts to $23^\circ.465$. From this time it gradually diminishes till about March 21, when the sun reaches the plane of the equator. At this time the days and nights are of equal length all over the earth, and the instant of time at which the sun's center is in the equatorial plane is called the instant of the equinox. The sun then passes to the northern side of the equator, and his declination or meridional altitude continues to increase till about June 22, when he becomes stationary, and then again shapes his course toward the equator. His maximum declination on the north side of the equator is exactly equal to that on the south, amounting to $23^\circ.465$. The sun now continues to approach the equator till about September 24, when he again reaches that plane, and a second equinox succeeds. Continuing still to move in the same direction, he declines from the equator southward, till he reaches his former limit about December 22; and so on continually.

The two small circles of the sphere, parallel to the equator, which pass through the two points where the declination is greatest, are called the *Solstices* or the *Tropics*; that on the northern hemisphere is called the *Tropic of Cancer*, and the other is called the *Tropic of Capricorn*.

These two parallels, which mark the extreme limits of the sun's declination, are, as has just been stated, equally distant from the equator, with regard to which the variations of declination on either side are perfectly symmetrical and uniform.

The observations of the sun's right ascensions and meridional altitudes, which have been made daily during so great a number of years, and under so many different meridians, furnish complete proof that the projection of the sun's orbit is a great circle of the celestial sphere, and that the orbit itself is wholly confined to the same plane.

The great circle which the sun describes in virtue of his proper motion is called the *Ecliptic*. It has received this name from the circumstance that the moon, during eclipses, is either in the same plane or very near it. These phenomena can, in fact, only happen when the sun, earth and moon are nearly in the same straight line, and consequently, when the moon is in the same plane with the earth and the sun. The angle formed by the planes of the ecliptic and equator, which is measured by the arc of a circle of declination intercepted between the equator and tropic, is called the *Obliquity of the Ecliptic*. The two points in which the equator and ecliptic intersect each other are called the *Equinoctial Points*; they are also denominated the *Nodes of the Equator*; and the straight line conceived to join them is the *Line of the Equinoxes*, or the *Line of the*

Nodes. The node through which the sun passes on coming from the south to the north of the north of the equator is called the *Ascending Node*, the opposite node is the *Descending Node*. A straight line passing through the center of the earth, perpendicular to the plane of the ecliptic, is called the *Axis of the Ecliptic*, and the points in which its prolongation meets the sphere are called its *Poles*—these denominations being analogous to those of the axis and poles of the equator. The two small circles of the sphere which pass through the poles of the ecliptic, and are parallel to the equator, are called the *Polar Circles*.

The ecliptic has been divided by astronomers, from time immemorial, into twelve equal parts, called *Signs*, each of which consequently contains 30 degrees. The names by which they are characterized are as follows:—

North of the Equator.—Aries, Taurus, Gemini, Cancer, Leo, Virgo; South of the Equator.—Libra, Scorpio, Sagittarius, Capricornus, Aquarius, Pisces.

In each of these signs the ancients formed groups of stars, which they denominated the *Zodiacal constellations*, not confined to the ecliptic, but included within an imaginary belt, extending 9° on each side of it, to which they gave the name of *Zodiac (circle or zone of the animals)*. The term *sign* is now employed only to denote an arc of 30°, and will probably soon be banished entirely from astronomical tables. It is now seldom used even for tables of the planets.

As the greater part of the celestial phenomena connected with the planetary system takes place either in the ecliptic or in planes not greatly inclined to it, it is found to be most convenient to refer the positions of the planets, and frequently those of the stars also, to that plane. The first point of Aries, which is the technical expression for the intersection of the ecliptic and equator, or the place of the sun at the vernal equinox, is assumed as the origin from which the degrees of the ecliptic, as well as of the equator, are counted from west to east, or in the direction of the sun's annual motion. The angular distance of the sun from this point is called his *Longitude*, and the longitude of a star is the arc intercepted on the ecliptic between the same point and a great circle passing through the star perpendicular to the ecliptic. The arc of this circle intercepted between the star and the ecliptic, or, which is the same thing, the complement of the star's distance from the pole of the ecliptic, is called the *Latitude* of the star; so that longitude and latitude bear the same relation to the ecliptic that right ascension and declination bear to the equator.

The sun's motion along the ecliptic is found not to be strictly uniform. In this place, let it suffice to notice that the sun is found to move more quickly in winter than in summer, the rate of motion changing from its maximum nearly in mid-winter to its minimum nearly in midsummer, and thence to its maximum again. But at no time does the motion differ greatly from its mean rate of very nearly 59' in a sidereal day. If we call the mean rate 10,000, then the greatest and least rates of motion are represented by the members 10,336 and 9,664 respectively.

The direction in which the sun travels round the ecliptic, and in which longitude is measured, is from west to east, that is, it is contrary to the direction in which the star-sphere rotates.

Since the sun travels thus around the celestial sphere, it is manifest that the successive returns of the sun to the meridian cannot recur after the same interval of time as the successive returns of any given star. If on any day the sun's center when he is crossing the meridian has a particular position on the star-sphere, then when that point of the star-sphere next returns to

the meridian—that is, one sidereal day later—the sun has traveled about 1° from that point, moving along the ecliptic in a direction opposed to that in which the star-sphere rotates. The star-sphere must, therefore, rotate a little further round before the sun will be on the meridian. As a convenient first approximation to the actual effects, let us make the supposition that the sun moves along the equator instead of the ecliptic, and that he moves exactly 1° in a sidereal day. In this case he would be exactly 1° from the meridian when the point he had occupied on the meridian the day before had reached the meridian. The point on the star-sphere would have completed the full circuit of 360° of rotation while the sun had completed only 359°, and his diurnal motion being therefore only $\frac{1}{360}$ of the star-sphere's, it follows that the solar day (or the interval between the sun's successive returns to the meridian) would be greater than the sidereal day in the ratio of 360 : 359. Therefore, the solar day being divided into 24x60 minutes, the sidereal day would manifestly be 4 min. shorter.

But as the sun moves in a circle inclined more than 23° to the equator, and as the sun's motion is slightly variable, and the mean rate less than 1° per sidereal day, these relations are not exactly presented.

Let us, as a next approximation, suppose the sun to move uniformly round the equator once in the course of a year of $365\frac{1}{4}$ days, and determine the length of a solar day on this assumption. It is clear that whatever the sun's daily retardation may be, he loses one complete circuit of the heavens in a year of $365\frac{1}{4}$ solar days. In other words, while the sun has been carried round $365\frac{1}{4}$ times by the diurnal rotation, the star-sphere has been carried round $366\frac{1}{4}$ times. Therefore, on our assumption

$$365\frac{1}{4} \text{ solar days} = 366\frac{1}{4} \text{ sidereal days}$$

$$\text{and a sidereal day} = \frac{365\frac{1}{4}}{366\frac{1}{4}} \text{ solar day}$$

$$= 23 \text{ h. } 56 \text{ m. } 4 \text{ s., approximately.}$$

This, in fact, indicates roughly the manner in which the mean solar day is connected with the sidereal day. It is only necessary in the above process to substitute the true length of the year for the value $365\frac{1}{4}$ days—meaning by the year, the year of seasons, measured by the successive returns of the sun to the equator as he crosses that circle with northward motion.

As the sun moves at a varying rate, it is manifest that the actual solar day measured by the successive returns of the sun to the meridian could not be constant in value, even if the sun moved round the equator. For the excess of a solar day over the sidereal day is caused by the motion of the sun on the star-sphere, and will be therefore greater or less according as the sun's motion on the star-sphere is greater or less. The actual solar day, therefore, exceeding the constant sidereal day by a variable quantity, must necessarily be itself variable. It is greater than the mean in December and January, when the sun is moving at a rate greater than his mean rate, and less in June and July when he moves at a less rate. And it is clear that if at the end of December the moment of the real sun passing the meridian were taken as the beginning of the mean solar day of twenty-four hours, then the next passage of the meridian by the actual sun would occur after the twenty-four hours of mean solar time had elapsed. Day after day the sun would come to the meridian at a later and later hour of mean solar time, until toward the end of March, when, the sun's rate having acquired its mean value, the actual sun would not lag any farther behind. From this time he would gain, until toward the end of June he would come to the meridian at noon of mean solar

time. In the remaining half year he would be in advance, that is, he would cross the meridian before noon of mean solar time. Toward the end of September he would have made his greatest advance compared with mean time, and in the remaining quarter of the year he would gradually lose more and more of that gain, until at the end of December he would again cross the meridian at noon of mean solar time.

But besides this cause of variation in the length of the true solar day, there is another depending on the inclination of the sun's apparent path on the heavens to the celestial equator. To conceive the effect of this cause, it is necessary to have regard to the motion of the sun with reference to the equator. The sun describes every day a small arc of the ecliptic. Through the extremities of this arc suppose two meridians to pass; the arc of the equator, which they intercept, is the sun's motion for that day referred to the equator, and the time which that arc takes to pass the meridian is equal to the excess of the astronomical day over the sidereal. But it is obvious that at the equinoxes the arc of the equator is smaller than the corresponding arc of the ecliptic, in the proportion of the cosine of the obliquity of the ecliptic; at the solstices, on the contrary, it is greater in the proportion of the secant of the same obliquity. The astronomical day is diminished in the first case, and lengthened in the second.

To have a mean astronomical day independent of these causes of inequality, astronomers have supposed a second sun to move uniformly on the ecliptic, and to pass over the extremities of the axis of the sun's orbit at the same instant as the real sun. This removes the inequality arising from the inequality of the sun's motion. To remove the inequality arising from the obliquity of the ecliptic, conceive a third sun to pass through the equinoxes at the same instant with the second sun, and to move along the equator in such a manner that the angular distances of the two suns at the vernal equinox shall be always equal. The interval between two consecutive returns of this third sun to the meridian forms the *mean astronomical day*. *Mean time* is measured by the number of the returns of this third sun to the meridian; and *true time* is measured by the number of returns of the real sun to the meridian. The arc of the equator, intercepted between two meridian circles drawn through the centers of the true sun and the imaginary third sun, when reduced to time, is what is called the *Equation of Time*.

The inclination of the ecliptic to the equator results necessarily, as already mentioned, in a difference of seasons. When on the equator, the sun, like an equatorial star, is above the horizon during one-half of the day, and below the horizon during the other half. When he is north of the equator he is above the horizon for more than half the day, and reaches a higher altitude at noon than when on the equator. When south of the equator he is below the horizon for more than half the day, and does not reach so great an altitude at noon as when he is on the equator. As he is perceptibly the source of light and heat, it follows that when he is north of the equator we receive (in our northern latitudes) more light and heat than when he is on the equator, and so much the more as his northerly declination is greater; while, when he is south of the equator we receive less light and heat than when he is on the equator, and so much the less as his southerly declination is greater. These results are equally accounted for whether we regard the earth as fixed, and the sun as really traveling round the heavenly sphere on his inclined path, or whether we suppose the sun to be fixed, and the earth to travel around him on a correspondingly inclined path. Let us follow the earth round, noting how the sun would

appear to move on the ecliptic, and also how the length of day would be affected by the varying position of the earth's axis with respect to the sun. When the earth is at the beginning of Libra, about March 20, the sun, as seen from the earth, appears at the beginning of Aries in the opposite part of the heavens, the north pole is just coming into light, and the sun is vertical to the equator, which, with all its parallels, is divided into two equal parts by the circle which forms the boundary between the dark and illuminated hemispheres, and therefore the days and nights are equal all over the earth. As the earth moves in the ecliptic, the north pole comes more and more into the light, and the days increase in length at all places north of the equator. When the earth comes to the beginning of Capricorn, the sun, as seen from the earth, appears at the beginning of Cancer about June 21; and the north pole of the earth inclines toward the sun, so as to bring into light all the north frigid zone, and more of each of the northern parallels of latitude in proportion as they are farther from the equator. As the earth advances from Capricorn towards Aries, and the sun appears to move from Cancer toward Libra, the north pole recedes from the light, which causes the days to decrease and the nights to increase in length till the earth comes to the beginning of Aries, and then they are equal as before—the boundary of light and darkness cutting the equator and all its parallels equally. The north pole then goes into the dark, and does not emerge till the earth has completed a semi-revolution of its orbit, or from September 22 till March 20. Similar changes occur, *mutatis mutandis*, in the southern hemisphere. For the purpose of actually picturing the relations of the various members of the solar system to his mind, the reader may conveniently use Sir J. Herschel's illustration, as follows:—Choose any well-leveled field. On it place a globe two feet in diameter to represent the sun; Mercury will be represented by a grain of mustard seed, on the circumference of a circle 164 feet in diameter for its orbit; Venus a pea, on a circle 284 feet in diameter; the earth a (somewhat larger) pea, on a circle of 430 feet; Mars a rather large pin's head, on a circle of 654 feet; the asteroids grains of sand, in orbits of from 1,000 to 1,200 feet; Jupiter a moderate-sized orange, on a circle of half a mile; Saturn a small orange on a circle of four-fifths of a mile; Uranus a full-sized cherry, on a circle more than one and a half miles; Neptune an extra-sized cherry, on a circle of two and a half miles in diameter.

We have seen that while the stars remain fixed, to all appearance, on the celestial concave, the sun circuits around a great circle of the star-sphere, moving always in one direction, and at a rate which, though variable in different parts of the circuit, does not vary largely, and is constant for each part of the ecliptic. Moreover, to ordinary observation, continued for periods of a few years, the sun's path in the heavens appears to remain always the same, and to bear the same relation to the poles and equator of the rotating star-sphere.

But we have now to consider bodies which neither remain fixed like the stars, nor move in a constant apparent path like the sun.

The moon is the most noteworthy of these bodies, because of her apparent size and brightness, and also because of the remarkable changes of appearance which she presents according to her varying position with reference to the sun. When she is seen near him in the heavens, she appears always like a fine sickle of light, with the horns turned away from him. When she is in the path of the heavens directly opposite to the sun, she appears with a full orb. When she is exactly midway between the point occupied by the sun and that

opposite to him, she appears as a semicircle of light, with the convexity toward the sun; and in positions intermediate to these she appears with more or less of her circle illuminated, according as she is nearer to or further from the point directly opposite the sun. All this corresponds with what would happen if the moon were an opaque orb nearer to the earth than the sun, and illuminated by him.

Now, when the moon is watched, even for a few hours only, she is found to be traveling on the star-sphere in the same direction as the sun (and, like him, on a path inclined to the equator), but much more rapidly than the sun travels. It is impossible to watch the moon completely round the heavens, because she is found to pass close to the sun once in each circuit, and when very near to him cannot be seen. But while she is visible, she travels continuously in one direction, and when she reappears, after having been for a day or two lost in the sunlight, she is seen to have shifted her place as though, during that interval, she had traveled continuously onward.

The moon's circuit of the star-sphere is found to be completed in about twenty-seven and one-third solar days. But her circuit, considered with reference to the sun, occupies a longer interval. Thus, suppose we observe her when she is opposite to the sun, or "full." Then she is in the same (or very nearly the same) place among the stars about twenty-seven and one-third days later. But in the meantime the sun has advanced along the ecliptic about 27° , and the point now directly opposite the sun has, of course, advanced by the same amount. The moon has, therefore, to travel further on before she is again exactly opposite the sun. It is found that this happens rather more than two days later; or in other words, that the interval between successive full moons amounts to about twenty-nine and one-half days. This interval is called a *lunar month*, or *lunation*; the period during which the moon completes the circuit of the heavens being called a *sidereal month*. The lunation is also called a *synodical month*.

The path in which the moon travels is found to be inclined at an angle of about $5^\circ 9'$ to the ecliptic. But continued observation shows that the path, while retaining this inclination, shifts slowly in position—the points where it intersects the ecliptic gradually retrograding (on the whole) until, in the course of about eighteen and one-half years, they have made a complete circuit of the ecliptic. It is also found that the moon moves, like the sun, with variable velocity in her apparent course. The parts of her path, however, where she moves most and least rapidly are not fixed in position like the corresponding parts of the sun's apparent circuit, but advance, traveling round in 8.85 years.

It follows, from the varying position of the moon's apparent path with respect to the ecliptic, that her range north and south of the equator is variable. When she crosses the ecliptic, at or near the two points where the ecliptic crosses the equator, the inclination of her path to the ecliptic is either added to or subtracted from the inclination of the ecliptic to the equator, so that her range in declination is, in one case, $23^\circ 27' + 5^\circ 9'$, or $28^\circ 36'$; and in the other, $23^\circ 27' - 5^\circ 9'$, or $18^\circ 18'$. When she crosses the ecliptic at or near the two points where the ecliptic is furthest from the equator, the inclination of her path to the equator is nearly the same as that of the ecliptic, the two paths—the ecliptic, or sun's path, and the apparent lunar path—crossing the equator at different points.

From the observed parallactic displacement of the moon it is manifest, apart from the lunar phases, that the moon's orbit relatively to the earth lies within the

sun's. While observing the stars, which maintain apparently a constant position on the uniformly rotating star-sphere, the ancients early noted five bodies, which seem to travel among the stars like the sun and moon, but not always in one direction. To these bodies they gave the name of planets, or wanderers (a term which also included the sun and moon, so that there were seven in all). Three could be seen sometimes throughout the night, sometimes in the morning, sometimes in the evening. To these were given the names Saturn, Jupiter and Mars; and careful observation showed that these bodies, when visible all through the night, always travel among the stars in a direction contrary to that of the sun's yearly and the moon's monthly motion, but that this retrograde motion continues only for a certain length of time, being preceded and followed by an advancing motion, which is greater in amount than the retrograde motion, so that, on the whole, these bodies are carried round in the same direction as the sun and moon. But this peculiarity was noticed, that when any planet was at the outermost parts of the successive loops the planet was lost to view in the sun's rays, lying nearly in the same part of the sky, whereas, when a planet was at the innermost parts of the successive loops the planet was always opposite the sun. This exact agreement between the times when the planet and sun were in *conjunction* or in *opposition*, and the tracing out of the apparent planetary loops, should have suggested, it would seem, a connection between the sun and planets; for if the earth were the center of the sun's motion, and each of the three planets had its looped path wherein to travel around the earth, there could be imagined no reason why the planet's motion round its loops should synchronise with the sun's motion on his nearly circular path.

This view should have been confirmed by the apparent motions of two other planets, Venus and Mercury, which were found to remain always within a certain apparent distance from the sun, never being seen on the part of the sky opposite to him. Venus, the brighter, was observed to have the greater range on either side of the sun, moving from about 46° on the east of the sun, when she is seen as the Evening Star, to about the same distance on the west of the sun, when she is seen as the Morning Star; while Mercury's greatest range on either side of the sun is more variable, being sometimes as great as 27° , and at other times not greater than 18° . So far as the motion of these planets on the star-sphere could be traced they appeared to follow looped paths, somewhat like the outer planets; but the nearer and farther parts of the successive loops were both lost to view, the two planets being always too near the sun's place in the heavens to be visible when tracing those parts of their paths.

The five planets were found to travel always within a certain range on either side of the ecliptic, Venus, which has the greatest range, being sometimes as far as 9° north, or 9° south of the equator. A zone, or band, having the ecliptic for its central circle, and bounded by circles 9° north and south of the ecliptic, so as to be 18° wide, came thus to be regarded as a sort of celestial roadway, outside of which the planets were never seen. This zone was called the *zodiac*, and it was probably in connection with the planetary rather than the solar motions that the zodiacal constellations were originally formed.

Considering the observed relation between the motions of all the five planets and those of the sun, it is remarkable that any of the astronomers of old time should have regarded the earth as the common center of solar and planetary movement. It is true that, by supposing each planet to travel around a center which

itself traveled round the earth, the looped paths of the planets might be explained. Yet the synchronism between all the movements in these small circles and the sun's supposed motion round the earth, was left wholly unexplained by that theory.

Far more reasonable was the ancient Egyptian system, by some described as identical with, but in any case closely resembling in essentials, the system of Tycho Brahe. Here the earth is the center of the motions of the sun and moon, but all the planets circle around the sun, Venus and Mercury moving in orbits passing between the earth and sun, while Mars, Jupiter, and Saturn move in orbits passing outside the earth. All the observed movements, and all the peculiarities of the observed relations, were fully explained by this system. It is not too much to say that Tycho's system is not only fully equal to the Copernican in its fitness to explain the observed relations, but that, until the law of gravitation had been established, the arguments for the Tychonic system, modified so as to correspond to Kepler's discovery of the shapes of the different orbits, were almost equal in weight to those used by the disciples of Copernicus. The slight advantage of the Copernican system in point of simplicity was counterbalanced by the difficulty of accepting, in those days, the belief that the stars lie at so inconceivably vast a distance that the motion of the earth in an enormous orbit around the sun (for the sun was known even then to lie many millions of miles from us) produces no perceptible change in the appearance and rotation of the star-sphere. That the whole span of the earth's orbit was as a mere point compared with the distance of the stars, so that the earth on one side of the sun was, in effect, at the center of the star-sphere, while it was equally at the center when on the opposite side, or many millions of miles from its former position, was not unreasonably regarded by Tycho Brahe as scarcely credible.

Leaving the rotation of the star-sphere out of consideration, the apparent motions of the sun, the moon, and the five planets known to the ancients, are most naturally explained by regarding the sun as the center around which Mercury, Venus, the earth, Mars, Jupiter and Saturn revolve in that order as to distance, while the moon revolves round the earth. For though there are thus two centers of motion, yet only a small body traveling in a relatively small orbit is set revolving round the earth, now presented as a subordinate orb in the system; and the whole family, including the moon, are set revolving around the sun, for the moon accompanies the earth in her circuit. In the Tychonic system the sun, though presented as a subordinate orb, because traveling round the earth, was yet set as the center round which all the planets revolved. Either system was, however, altogether more reasonable than the Ptolemaic, in which all the planets were supposed to move around imaginary centers. It is hardly necessary to point out that the arrangement suggested by Copernicus explains the motions of the sun and moon as readily as the system which presents both these bodies as moving around the earth. Peculiarities in the motions of the earth and moon are indeed left unaccounted for by a simple theory of uniform circular motion around the sun and earth as centers; but so they were in the Ptolemaic system until eccentric and epicyclic movements were provided, and these were as admissible in the Copernican theory as in the Ptolemaic. But although the Copernican theory explains the general features of planetary motion, it could not, as originally advanced, explain those features which had rendered necessary the eccentrics and the subordinate epicycles of the Ptolemaic system. It was known to

Copernicus that the earth does not move uniformly in a circle around the sun as center, but by an eccentric path with varying velocity. He might, therefore, reasonably assume that the other planets have paths similarly eccentric, and move with varying velocities. But he thought it necessary to explain the planetary motions by uniform motion in circles, using such contrivances to save appearances as the Ptolemaic system had rendered familiar to astronomers. Tycho Brahe, having completed a series of observations of Mars, the nearest planet moving on a manifestly eccentric orbit, Kepler tested the theory of Copernicus in order to ascertain whether any eclipse could account for the observed positions of the planet. Kepler was led at last to abandon the attempt to explain the motions of Mars by combining circular uniform motions. Passing to the ellipse, as the curve which Mars appeared to follow, and testing various empiric laws of motion in an elliptic orbit, he at length lighted upon the actual relation, presented in his first two laws as true for all the planets, though actually proved only in the case of Mars. The laws are these:—

1. *Every planet moves in an elliptical orbit, in one focus of which the sun is situated.*

2. *The line drawn from the sun to a planet, or the radius-vector of the planet, sweeps over equal areas in equal times.*

It remained now to discover if any law connected the periods in which the planets pursue their different paths. He did not at first try to connect the periods and the distances by any direct numerical relation, probably because he had recognized in the second law the probable existence of geometrical relations. But after many years of inquiry he arrived at the conclusion, that probably the required law connected the powers of the numbers representing the periods and the distances. It affords a strange evidence of the ponderous nature of Kepler's movements, that after this idea had occurred to him, ten weeks, instead of some ten minutes, elapsed before he had verified it. The law connecting the periods and distances—Kepler's third law—is this:—

3. *The squares of the numbers representing the periodic times of the planets vary as the cubes of the numbers representing their mean distances.*

The three laws of Kepler are approximately true for bodies circling around the same center. They do not apply to bodies circling around different centers. It was probably the recognition of this fact which first put astronomers on the track of the theory that the law depends on some force residing in the centers round which different bodies move. Newton certainly had given attention to this influence before he dealt with the moon's attraction earthward as a case of the action of terrestrial gravity. But, be that as it may, it is certain that so soon as the action of the earth's attraction on the moon had been demonstrated by him he extended the law of gravitation to all cases of motion around a central orb. It then became clear that the laws of Kepler are consequences of the general law of gravitation—the law, viz., that

Every particle of matter in the universe attracts every other particle with a force varying directly as the masses, and inversely as the square of the distances.

The proof of the law of gravitation divides itself into three distinct parts:—

First, The proof that the force acting on the moon is equal to the force of terrestrial gravity, reduced as the inverse squares of the distances of the moon and of a point on the earth's surface, from the center of the earth.

Secondly, The proof that a system of bodies circling around a central body like the sun, attracting them with a force inversely proportionate to their respective distances, would obey the laws of Kepler, or some modification of those laws, giving results according with the motions actually observed.

Thirdly, The proof that the mutual attractions of the several members of any system, and the attractions of members of one system on bodies belonging to another system (as, for instance, of the sun upon the moon regarded as a dependent of the earth), would result in such perturbations from the paths due to the attractions of the central body as are observed actually to take place.

The moon is, roughly, at a distance from the earth's center equal to 60 radii of the earth, and therefore the earth's moving force is less on her than on a body at the earth's surface as 1 to 3600. Now, regarding the moon's orbit as a circle, it is easily shown that, if at any moment the earth's attraction ceased to act, so that for the next second the moon moved on a tangent to her present course, her distance from the earth's center at the end of that second would be rather more than $\frac{1}{13}$ th of an inch greater than at the beginning of the second. It follows that her fall toward the earth in a second on account of the earth's attraction amounts to rather less than $\frac{1}{13}$ th of an inch. But the fall of a body near the earth's surface is about $16\frac{1}{13}$ th feet, or nearly 193 inches per second, or nearly 193×19 times greater than the fall of the moon toward the earth per second; that is, about 3600 times greater. In other words, the moon is attracted toward the earth precisely as she would be if the force of gravity acting on bodies near her surface ruled her also, the law of variation of the force with distance being that of the inverse squares.

This relation which is true for elliptic orbits, is general for all systems, and gives the means of comparing the masses of different systems. But it is necessary to observe a modification which Kepler's third law and this extension of it have to undergo to make them strictly true (as regards, at least, the unperturbed motions of the planets). The masses of the planets, though very small, yet bear definite relations to the sun, and instead of considering each planet as swayed by the sun's mass, we must regard each as swayed by the sum of its own mass and the sun's, supposed to be gathered at the sun's center. Thus we must regard the planets as revolving around centers of different attractive energy; Jupiter round a center equal in mass to Jupiter and the sun; Saturn round a center equal in mass to Saturn and the sun, etc. Instead, then, of the ratio being constant for the solar system, we find that this ratio for any given planet is proportional to the sun's mass added to that planet's.

These laws suffice to enable us to deduce from the observed periods of the planets their true mean distances, velocities, etc., and from the observed period of the satellite of any planet, the ratio of the planet's mass to the sun's. The eccentricities of the planetary orbits are partly deduced from observation, and partly from the law of the equable description of areas. The inclinations of the orbits, and, of course, all elements relating to the planets' own globes, their dimensions, compression, inclination, rotation, and so on, are obtained by telescopic observation and measurement.

The sun, the central and ruling body of the planetary system, and the source of light and heat to our earth and all the members of that system, is a globe about 852,900 miles in diameter. So far as observation extends, his figure is perfectly spherical, no difference having been observed between his polar and spherical

diameters. It has been well remarked, indeed, by Sir G. Airy, that if any observer could by ordinary modes of measurement satisfy himself that a real difference existed between the diameters, that observer would have proved the inexactness of his own work; for the absence of any measurable compression comes out as the result of comparisons between thousands of observations of the sun's limbs made at Greenwich and other leading observatories. The volume of the sun exceeds the earth's 1,252,700 times. His mean density is almost exactly one-fourth of the earth's, and his mass exceeds hers about 316,000 times. Gravity at the surface of the sun exceeds terrestrial gravity about 27.1 times, so that a body dropped from rest near the sun's surface would fall through 436 feet in the first second, and have acquired a velocity of 872 feet per second.

Viewed with the naked eye, the sun appears only as a luminous mass of intense and uniform brightness; but when examined with the telescope, his surface is frequently observed to be mottled over with a number of dark spots, of irregular and ill-defined forms, constantly varying in appearance, situation, and magnitude. These spots are occasionally of immense size, so as to be visible even without the aid of the telescope; and their number is frequently so great that they occupy a considerable portion of the sun's surface. Sir W. Herschel observed one in 1779, the diameter of which exceeded 50,000 miles, more than six times the diameter of the earth; and Scheiner affirms that he has seen no less than fifty on the sun's disk at once. Most of them have a deep black nucleus, surrounded by a fainter shade, or *umbra*, of which the inner part, nearest to the nucleus, is brighter than the exterior portion. The boundary between the nucleus and umbra is in general tolerably well defined; and beyond the umbra a stripe of light appears more vivid than the rest of the sun.

The discovery of the sun's spots has been attributed to Fabricius, Galileo, and Scheiner, and has been claimed for the English astronomer Harriot. Among these conflicting pretensions it is perhaps impossible to arrive at the truth; but the matter is of little importance; the discovery is one which followed inevitably that of the telescope, and an accidental priority of observation can hardly be considered as establishing any claim to merit.

The solar spots furnish an extensive subject of curious speculation. They are interesting on account of their establishing the fact of the rotation of the sun, and affording the means of determining its period.

Sir William Herschel, with a view to ascertain more accurately the nature of the sun, made frequent observations upon it from the year 1779 to the year 1794. He imagined the dark spots on the sun to be mountains, which, considering the great attraction exerted by the sun upon bodies placed at its surface, and the slow revolution it has upon its axis, he thought might be more than 300 miles high, and yet stand very firmly. He says that in August, 1792 he examined the sun with several powers from 90 to 500, when it evidently appeared that the dark spots are the opaque ground or body of the sun, and that the luminous part is an atmosphere, through which, when interrupted or broken, we obtain a view of the sun itself. Hence he concluded that the sun has a very extensive atmosphere, consisting of elastic fluids that are more or less lucid and transparent, and of which the lucid ones furnish us with light. This atmosphere, he thought, cannot be less than 1,843 nor more than 2,765 miles in height; and he supposed that the density of the luminous solar clouds needs not be much more than that of our aurora borealis, in order to produce the effects with which we are acquainted. The sun, then, if this hypothesis be admitted, "is similar to the other globes of the solar system with regard to its

solidity, its atmosphere, its surface diversified with mountains and valleys, its rotation on its axis, and the fall of heavy bodies on its surface; it therefore appears to be a very eminent, large, and lucid planet, the primary one in our system, disseminating its light and heat to all the bodies with which it is connected."

Herschel supposed that there are two regions or strata of solar clouds; that the inferior stratum is opaque, and probably not unlike our own atmosphere, while the superior is the repository of light, which it darts forth in vast quantities in all directions. The inferior clouds act as a curtain to screen the body of the sun from the intense brilliancy and heat of the superior regions, and, by reflecting back nearly one-half of the rays which they receive from the luminous clouds, contribute also greatly to increase the quantity of light which the latter send forth into space, and thereby perform an important function in the economy of the solar system. The luminous clouds prevent us in general from seeing the solid nucleus of the sun; but in order to account for the spots, he supposes an empyreal elastic gas to be constantly forming at the surface, which, carried upward by reason of its inferior density, forces its way through the planetary or lower clouds, and mixing itself with the gases which have their residence in the superior stratum, causes decomposition of the luminous matter, and gives rise to those appearances which he describes under the name of *corrugations*. Through the openings made by this accidental removal of the luminous clouds, the solid body of the sun becomes visible, which, not being lucid, gives the appearance of the dark spots or nuclei seen through the telescope. The length of time during which the spots continue visible renders it evident that the luminous matter of the sun cannot be of a liquid or gaseous nature; for, in either case, the vacuity made up by its accidental removal would instantly be filled up, and the uniformity of appearance invariably maintained.

But, perhaps, the most important of all the discoveries which have been made respecting the sun spots, are those which relate to the variation of these objects in number, and in the amount of solar area which they cover. We owe the initiation of observations on these points to Schwabe of Dessau. They were commenced in the year 1826, and continued without intermission, except in one case, during the astronomer's illness, for forty-six years. Before many years had elapsed, Schwabe discovered that the spots wax and wane in frequency in a period of about eleven years. At the time of spot-minimum the sun remains often for several days not only clear of spots, but with a singular smoothness of aspect, even the minute mottlings ordinarily seen on his surface either passing away for a time or becoming less conspicuous than usual. From such an epoch there is a gradual return to the spotted condition, and usually in four or five years the maximum of spot-frequency is reached; then there is a more gradual reduction, until, in rather more than eleven years on the average, the minimum is reached.

Among the most interesting discoveries in solar physics are those which have been effected by means of the spectroscopic analysis, not only as regards the constitution of the sun himself, but as to the nature of the solar spots and facule, as well as of the various objects which lie outside the sun's visible surface, and are only rendered discernible during the darkness of total solar eclipses.

The evidence of the spectroscope respecting the sun's constitution is too intimately associated with the history of spectroscopic analysis to be properly discussed at any length in this place. We propose, therefore, to present results, rather than to describe in detail the processes by

which these results have been obtained, or the considerations on which must be based the interpretation of such results.

It has been shown, then, that the light of the sun comes from an orb glowing with intense *white* light—that is, light of all refrangibilities. Hence the sun is either liquid or solid, or if vaporous, then so greatly compressed that, in fact, the condition of its vapors is unlike that of any gases with which we are familiar. But inasmuch as the rainbow-tinted streak constituting the solar spectrum is crossed by a multitude of dark lines, it is seen that the glowing mass of the sun is surrounded by a complex vaporous envelope at a lower temperature. Nevertheless we are not to suppose that the vapors constituting the solar atmosphere are in any sense cool. In fact, we find from the position of the dark lines of the solar spectrum that the vapors of magnesium and sodium, of iron, copper, and other metals, exist in the true solar atmosphere, which implies an excessive intensity of heat. We know also that the vapors of the solar atmosphere, although less intensely hot than the glowing mass of the sun, are yet so hot as to be brightly luminous. It must not be supposed either that no other terrestrial elements exist in the sun, or that no other coincidences are recognizable. With each improvement in spectroscopic appliances fresh coincidences are determined. Moreover, it is certain that many elements existing in the sun may forever escape notice, simply because their vapors in the solar atmosphere may be either insufficient in quantity, or too low down to produce any recognizable effect.

The evidence given by the spectroscope respecting the solar spots confirms the theory that these are due to the existence of masses of relatively cool vapors at a lower level, and therefore relatively more compressed than the vapors elsewhere existing in the solar atmosphere. For the spectrum of the umbra of a spot differs chiefly from the spectrum of the solar photosphere in the greater strength and breadth of some of the dark lines.

Another very curious phenomenon connected with the sun is the faint nebulous aurora which accompanies him, known by the name of the *Zodiacal Light*. This phenomenon was first observed by Kepler, who described its appearance with sufficient accuracy, and supposed it to be the atmosphere of the sun. Dominic Cassini, however, to whom its discovery has been generally but erroneously attributed, was the first who observed it attentively, and gave it the name which it now bears. It is visible immediately before sunrise, or after sunset, in the place where the sun is about to appear, or where he has just quitted the horizon.

The general opinion respecting the zodiacal light at the present day is, that it forms the outer part of the solar corona, so that if the light of the sun could be for a time obliterated without rendering his appendages invisible, we could see the corona merging gradually into the faint glow of the zodiacal light.

MERCURY AND VENUS.

Mercury is a small body, but emits a very bright white light, though he is seldom to be seen, always keeping near the sun.

Mercury is about 3,060 English miles in diameter, and his mean distance from the sun about thirty-five millions of miles. On account of his smallness and brilliancy, it is extremely difficult to find any spot on his disk so distinctly marked as to afford the means of determining his rotation. An attentive observation of the variation of the phases of Mercury led Schröter to infer that the planet revolves about its axis in a period of twenty-four hours five minutes thirty seconds. M. Harding discovered in 1801 an obscure streak on the southern hemisphere of the planet, the observations of

which, together with those of a spot discovered by Schröter, gave the same period of rotation. Schröter states that Mercury's form is spherical, exhibiting no sensible compression; that his equator is very considerably inclined to his orbit, and the differences of his days and seasons must consequently be very great; and that there are mountains on his surface which cast very long shadows, and of which the height bears a greater proportion to the diameter of the planet than those of the Earth, the Moon, or even of Venus. The height of Chimborazo is $\frac{1}{10.7}$ of the radius of the earth; one of the mountains in the moon has been estimated at $\frac{1}{8.1}$ of her radius; the highest in Venus at $\frac{1}{1.4}$; and one in Mercury at $\frac{1}{1.8}$. But recent observations render it exceedingly doubtful how far Schröter's observations can be trusted. There are no observations to prove decisively whether Mercury is surrounded by an atmosphere.

Venus, the most beautiful object in the heavens, is about 7,510 English miles in diameter, and is placed at the distance of sixty-six millions of miles from the sun. Although the oscillations of this planet are considerably greater than those of Mercury, and she is seldom invisible, yet on account of the uniform brilliancy of her disk, it is extremely difficult to ascertain the period of her rotation. Dominic Cassini, after having long fruitlessly attempted to discover any object on her surface so well defined as to enable him to follow its motions, at length, in 1667, perceived a bright spot, distant from the southern horn a little more than a fourth part of the diameter of the disk, and near the eastern edge. By continuing his observations of this spot, Cassini concluded the rotation of Venus to be performed in about twenty-three hours; but he does not seem to have considered this conclusion as deserving of much confidence. In the year 1726 Bianchini, an Italian astronomer, made a number of similar observations for the same purpose, from which he inferred that the rotation of the planet is performed in twenty-four days eight hours. The younger Cassini has shown, however, that the observations of Bianchini, as well as those of his father, could be explained by a rotation of twenty-three hours and twenty-one or twenty-two minutes, whereas the rotation of twenty-four days eight hours cannot be reconciled with the appearances observed by the elder Cassini. The determination of Cassini was regarded by astronomers as the more probable of the two, particularly as Bianchini was not able to make his observations in a connected manner, because a neighboring building intercepted his view of the planet, and obliged him to transport his telescope to a different situation. The question of the rotation of Venus was again attacked by Schröter, who found it to be performed in twenty-three hours twenty-one minutes nineteen seconds. Each of the three observers found the inclination of the axis of rotation to the axis of the ecliptic to be about 75° . Much doubt, however, still exists with respect to the value of this element, which De Vico sets at little more than 50° .

Since the time of rotation of Mercury and Venus is nearly equal to that of the earth, the compression of these planets at the poles, which results from the centrifugal force, ought also to be nearly in the same proportion. But at the distance of the earth the compression must be imperceptible even in the case of Venus; for, supposing it to amount to $\frac{1}{810}$, the difference between the radius of her poles and that of her equator would only amount to a tenth of a second as seen from the earth.

During the transits of Venus over the sun's disk in 1761 and 1769 a sort of penumbral light was observed round the planet by several astronomers, which was

occasioned, without doubt, by the refractive powers of her atmosphere. Wargentin remarked that the limb of Venus which had gone off the sun, showed itself with a faint light during almost the whole time of emersion. Bergman, who observed the transit of 1761 at Upsal, says that at the ingress the part which had not come upon the sun was visible, though dark, and was surrounded by a crescent of faint light; but this appearance was much more remarkable at the egress; for as soon as any part of the planet had disengaged itself from the sun's disk, that part was visible with a like crescent, but brighter. As more of the planet's disk disengaged itself from that of the sun, the part of the crescent farthest from the sun grew fainter, and vanished, until at last only the horns could be seen. The total immersion and emersion were not instantaneous; but as two drops of water, when about to separate, form a ligament between them, so there was a dark shade stretched out between Venus and the sun; and when this ligament broke, the planet seemed to have got about an eighth part of her diameter from the limb of the sun. The numerous accounts of the two transits which have been published abound with analogous observations, indicating the existence of an atmosphere of considerable height and density. During the transit of 1874 these appearances were so satisfactorily seen, that no doubt can remain as to their reality. Schröter calculated that the horizontal refraction of the atmosphere of Venus must amount to $37' 34''$, differing little from that of the terrestrial atmosphere. A twilight which he perceived on the cusps afforded him the data from which he deduced this conclusion, on which, however, very little reliance can be placed.

The atmosphere of Venus has been analysed with the spectroscope by Vogel, and the existence of aqueous vapor is regarded as demonstrated. On the occasion of the late transit (1874) Tacchini made spectroscopic observations, which seem more satisfactorily to establish the fact that there is water on Venus, than Vogel's observations.

Cassini and Montaigne imagined that they had observed a satellite accompanying Venus; but this appears to have been an optical illusion arising from the strong light of the planet reflected back from the convex surface of the eye upon the eye-glass of the telescope, and thence reflected a second time back to the eye. During the transits of Venus in 1761 and 1769, and in the transit of 1874, no trace of a satellite was seen; and there can be now no doubt whatever that Venice is without a satellite.

THE EARTH.

The earth is the third member of the solar system in order of distance from the sun. From what has been already shown, in determining the relative position of the earth and the celestial bodies seen in our skies, we know that the earth is a globe, rotating on her axis once in a day, and circling around the sun in an orbit of great extent once in a year.

It has been found by numerous and accurate experiments, that the lengths of arcs of 1° on the same meridian are greater in proportion as we advance nearer the pole. Hence, on account of the similarity of the isosceles triangles of which these arcs form the bases, their sides, or the terrestrial radii, must also be longer, and consequently the convexity of the earth is less toward the poles than at the equator. The surface of the earth is extremely irregular, even independently of the inequalities occasioned by mountains and cavities; yet it has been discovered that the meridional curves differ almost insensibly from ellipses; whence it is concluded that the figure of the earth is an ellipsoid of revolution about its shortest axis. In comparing the results of the

various measurements which have been made with the formulæ belonging to the dimensions of such a body, this conclusion has been fully verified; and the lengths of the arcs, the ellipticity, the distance of the pole from the equator, and, in short, all the elements of the spheroid, have been determined.

An arc of the meridian in India was measured by Col. Lampton in the early part of this century. But its value has been much increased by Col. Everest's extension of the arc. The arc of Lampton, extending from Punnæ (lat. $8^{\circ} 9' 35''$) to Damargida (lat. $18^{\circ} 3' 15''$), was measured after the model of the English trigonometrical survey. From Damargida, where Lampton's arc terminated, another was measured by Col. Everest to Kaliana (lat. $29^{\circ} 30' 48''$), a space of 797 miles, covering an arc of $11^{\circ} 27' 33''$, the latest geodetical improvements being introduced. The whole extent of Lampton's and Col. Everest's operations includes a continuous arc of $21^{\circ} 21'$ (1,477 miles). The work was rivalled in extent by a vast operation executed in Russia and other northern countries of Europe, by which an arc of $25^{\circ} 20'$, extending from the banks of the Danube to the shores of the Arctic Sea, near the North Cape, was measured under the general superintendence and direction of W. Struve.

The arcs of India and of Russia include a space from lat. 8° to lat. 71° , with the exception of only about sixteen degrees, and are unquestionably the most important which exist for the determination of the earth's figure. When to them we add the French arc of $12^{\circ} 22'$ in a medium latitude, it will scarcely be necessary to take into account any other, at least for the northern hemisphere.

Capt. A. R. Clark, R. E., combining all the results obtained up to the year 1860, arrived at conclusions thus stated by Sir J. Herschel:—"The earth is not exactly an ellipsoid of revolution. The equator itself is slightly elliptic, the longer and shorter diameters being respectively 41,852,864, and 41,843,096 feet. The ellipticity of the equatorial circumference is therefore $\frac{1}{318}$, and the excess of its longer over its shorter diameter about two miles. The vertices of the longer diameter are situated in longitude $14^{\circ} 23'$ E. and $194^{\circ} 23'$ E. of Greenwich, and of its shorter in $104^{\circ} 23'$ E. and $284^{\circ} 23'$ E. The polar axis of the earth is 41,707,796 feet in length, and consequently the most elliptic meridian (that of longitude $14^{\circ} 23'$ and $194^{\circ} 23'$) has for its ellipticity $\frac{1}{317.5}$, and the least (that of longitude $104^{\circ} 23'$ and $284^{\circ} 23'$) an ellipticity of $\frac{1}{318.3}$."

Gen. Schubert, using a method which Sir J. Herschel justly regards as less trustworthy, "makes the ellipticity of the equator $\frac{1}{318.5}$, and places the vertices of the longer axis $26^{\circ} 41'$ to the eastward of Capt. Clark's. His polar axis, as deduced from each of the three great meridian arcs, the Russian, Indian, and French respectively, is 41,711,000 feet, 41,712,534 feet, and 41,697,496 feet, the mean of which, giving to each a weight proportional to the length of the arc from which it is deduced, is 41,708,710 feet."

The figure and volume of the earth being thus determined, we require only to ascertain its mean density in order to know its mass. But this problem has not been solved, probably cannot be solved, with any very near approach to exactness.

It may be fairly assumed that the earth's mean density amounts to about 5.6 times the density of water, combining which with the known dimensions of the earth, we find that the earth's weight in tons may be roundly expressed by the number 6,000,000,000,000,000,000.

We have next to inquire into the rotation of the earth about its axis, and especially into the position of that axis.

The longitudes of the stars are measured on the ecliptic from the vernal equinox; and therefore, if the line of the equinoxes, which is the same as the line of the nodes, is invariable, the longitude of any star will always be the same, whatever interval of time may elapse between two observations of that longitude. But on comparing the actual state of the heavens with the observations recorded by ancient astronomers, it is perceived that the longitudes of all the stars are considerably increased. The phenomenon is to be explained by attributing to the equinoctial points a retrograde motion from east to west, in consequence of which the sun, whose motion is direct, arrives at them sooner than if they remained at rest; and therefore the equinoxes, and spring, autumn, and the other seasons happen before the sun has completed an entire circuit. On this account the motion has been denominated the *Precession of the Equinoxes*. As this motion is extremely slow, its exact amount can be discovered only by a comparison of observations separated from each other by long intervals of time. The comparison of modern observations with those of Hipparchus gives as its annual amount $50\frac{2}{3}''$. The mean result of the observations of Tycho, compared with those of Lacaille, gives $50\frac{2}{3}''$. On comparing modern observations with one another, we find $50''\cdot06$. Delambre, in his solar tables, supposes the annual precession to be equal to $50''\cdot1$. According to this estimate the equinoctial points go backward at the rate of 1° in 71.6 years nearly, and therefore, will make a complete revolution of the heavens in about 25,868 years.

If the sun and moon moved in the plane of the equator, there would evidently be no precession; and the effect of their action in producing it varies with their distance from that plane. Twice a year, therefore, the effect of the sun in causing precession is nothing; and twice a year, namely, at the solstices, it is a maximum. On this account the obliquity of the ecliptic is subject to a semi-annual variation; for the sun's force, which tends to produce a change in the obliquity, is variable, while the diurnal motion of the earth, which prevents the change from taking place, is constant. Hence the plane of the equator is subject to an irregular motion which is technically called the *Solar Nutation*. The existence of the solar nutation is, however, only a deduction from theory, for its amount is too small to be perceptible by observation; but a similar effect of the moon's action is sufficiently appreciable, and was, in fact, discovered by Bradley before theory had indicated its existence. Its period, however, is different, and depends on the time of the revolution of the moon's nodes, which is performed in eighteen years and about seven months. During this time the intersection of the lunar orbit with the ecliptic has receded through a complete circumference; and the inequality of the moon's action will consequently in the same time, have passed through all its different degrees. Bradley observed that the declinations of the stars continued to augment during the nine years, that they diminished during nine years following, and that the greatest change of declination amounted to $18''$. He remarked further, that this motion was connected with an irregularity of the precession of the equinoxes, which followed exactly the same period; whence he concluded that the motion of the poles of the equator, occasioned by this vibration of its plane, was not confined to the solstitial colure. A series of observations on stars differently situated proved that all the phenomena could be explained on the hypothesis that the pole of the equator describes in eighteen years a small circle of $18''$ diameter, contrary to the order of the signs; or that the axis of the earth, following the circumference of this circle, describes the

surface of a cone, the axis of which forms with its side an angle of $9''$. This apparent vibratory motion is denominated the *Nutation of the Earth's Axis*.

While the shape of the earth's orbit and the position of its center (whose longitude = long. of perih. $\times 180^\circ$) thus undergo continual alteration, her mean distance from the sun remains appreciably constant. This we know from the length of the year, which certainly has not changed ten seconds in length since the time of the Chaldean determination of that element.

There are various ways of determining the sun's distance from the earth in terms of the earth's semidiameter. The distance of a planet from the sun may likewise be obtained if we can find the means of measuring its distance from the earth at any epoch, for the geocentric positions of the sun and the planet being known from the theory of their motions, the radius vector of the orbit, or planet's distance from the sun at that epoch, may be found by a simple trigonometrical computation. To determine the distance of a planet from the earth it might seem only necessary to determine its horizontal parallax; but in general the parallaxes of the planets are quantities by far too small to be directly observed.

The application of the transits of Venus to the determination of the sun's distance was first pointed out by Dr. Halley, when he announced the transit of 1761. The transit of Venus in 1769 was observed in many different parts of the world. The result of the whole of the observations led to the conclusion, that the parallax of the sun is included within the limits $8''.5$ and $8''.7$. The mean $8''.6$ was adopted by Delambre and Lalande; and later the value $8''.5776$ was deduced by Encke from a careful re-examination of all the observations made in 1761 and 1769. But several methods have been since applied to the determination of the solar parallax, with results which appear to agree in indicating a larger value for the parallax, or in other words, a smaller value for the sun's distance, than had been deduced from the transits of 1761 and 1769.

One of these depends on the moon's motions, and was first indicated by Laplace toward the close of the last century. Since the moon's distance from the earth, though small compared with the sun's, bears yet a measurable ratio thereto, it follows that there is not a perfect symmetry between the perturbations produced by the sun when the moon is passing from third to first quarter, and from first to third. The effect of this circumstance is recognizable in the lunar motions, which are affected by a minute variation arising from this cause, and called the *Parallactic Inequality*. It amounts at the maximum to about $2'$; and as it depends on the proportion of the sun's distance to the moon's known distance, its amount supplies a means of determining the solar parallax. In 1854 Hansen announced, in a letter addressed to the astronomer royal, that this method, applied to his new tables of the lunar motions, gives a parallax of $8''.9159$.

A second method depends on the fact, that the earth in reality revolves, in the course of a lunar month, around the common center of gravity of her own globe and the moon's. The diameter of the orbit thus circumscribed by the earth (in the same sense, at least, as the moon may be said to circuit in her monthly orbit) amounts to about 6,000 miles, and by the radius of this small orbit the earth is sometimes in advance of and sometimes behind her mean position in heliocentric longitude. The sun's geocentric longitude is affected to precisely the same degree as the earth's heliocentric longitude; and by determining the actual amount of the sun's displacement, we can ascertain what angle the mean diameter of the earth's monthly orbit subtends at the sun. Leverrier, by the careful study of a great

number of observations of the sun made at the principal observatories in Europe, came to the conclusion that the solar parallax is $8''.95$. But Mr. Stone of Greenwich detected a numerical error in Leverrier's computations, and when this is corrected, the value $8''.91$ results. Prof. Newcomb of Washington has by the same method deduced the value $8''.84$.

THE MOON AND ITS MOTIONS.

The different appearances or phases of the moon were probably the first celestial phenomena observed with any degree of attention. The following definitions may conveniently be given in this place. When the moon passes the meridian at the same time with the sun, she is said to be in *Conjunction*. The two points of her orbit in which she is situated when in opposition and conjunction are called the *Syzygies*; those which are 90° distant from the sun are called the *Quadratures*; and the intermediate points between the syzygies and quadratures are called the *Octants*.

A slight attention to the lunar phases during a single revolution will be sufficient to prove that they are occasioned by the reflection of the sun's light from the opaque spherical surface of the moon. This fact, which was recognized in the earliest ages, can be made obvious by the help of a diagram. If the moon is an opaque body, we can only see that portion of her enlightened side which is toward the earth.

Since the parallax of the moon is subject to incessant variation, it is necessary to assume a certain mean value, about which the true and apparent values may be conceived to oscillate. This is called the constant of parallax. The best modern observations assign $57' 2''.7$ as the value of the lunar mean equatorial horizontal parallax, corresponding to a distance of 238,818 miles.

The *Ascending Node* of the lunar orbit is that point of the ecliptic through which the moon passes when she rises above the ecliptic toward the north pole. The *Descending Node* is the opposite point of the ecliptic, through which she passes when she descends below that plane toward the south. The position of the nodes is not fixed in the heavens. They move in a retrograde direction, or contrary to the order of the signs; and their motion is so rapid that its effects become very apparent after one or two revolutions.

The mean retrograde motion of the nodes is found, by the comparison of observations made at distant epochs, to amount to $19^\circ 21' 18''.3$ in a mean solar year, and the time in which they make a tropical revolution is consequently 6793.391 mean solar days. The inclination of the lunar orbit is observed to vary between $5^\circ 3'$ and $5^\circ 13'$. The mean inclination may be taken at $5^\circ 8'$.

The inclination of the lunar orbit to the plane of the terrestrial equator occasions considerable differences in the intervals between the moon's rising or setting on successive days, and gives rise to the phenomenon of the *Harvest Moon*.

The moon's orbit at any moment is an ellipse, having the earth at one of the foci; but this orbit is continually changing in form and position, but on the whole advancing at an average rate of $40\frac{3}{4}^\circ$ per annum, so as to complete a sidereal revolution in 3232.575 mean solar days. These changes, like those which affect the inclination of the orbit and the position of the nodes, are due to the perturbing influence of the sun on the moon's motions relatively to the earth. The consideration of these perturbations, whether as affecting the figure and position of the moon's orbit, or her motions in that orbit, constitutes what is called the *Lunar Theory*.

Understanding by the term *month* the time which the moon employs to make an entire revolution relatively

to any given point, movable or fixed, we have as many different species of months as there are different motions with which that of the moon can be compared. For example, if we estimate her revolution relatively to the sun, the month will be the time which elapses between two consecutive conjunctions or oppositions. This is called the *synodic month*, *lunar month*, or *lunation*. If we consider her revolution as completed whenshe has gone through 360° of longitude counted from the movable equinox, we shall have the *tropical* or *periodic month*. The interval between two successive conjunctions with the same fixed star is the *sidereal month*. A revolution with regard to the apsides of her orbit, that is to say, the time in which she returns to her perigee or apogee, gives the *anomalistic month*. And, finally, the revolution with regard to the nodes is the *nodical month*.

The moon at all times presents very nearly the same face to the earth. It is proved by observation, that there are some variations in the apparent position of the spots on the lunar disk. Those which are situated very near the border of the disk alternately disappear and become visible, making stated periodical oscillations, which indicate a sort of vibratory motion of the lunar globe (apparent only), which is known by the appellation of the *Libration*.

The rotation of the moon is sensibly uniform, while the motion of revolution is variable. The apparent rotation occasioned by the revolution of the moon round the earth is, consequently, not exactly counterbalanced by the real rotation, which remains constantly the same. Hence the different points of the lunar globe must appear to turn about her center, sometimes in one direction, and sometimes in the contrary, and the same appearances be produced as would result from a small oscillation of the moon, in the plane of her orbit, about the radius vector drawn from her center to the earth. The spots near the eastern or western edge of her disk disappear according as her motion in her orbit is more or less rapid than her mean motion. This is called the *Libration in Longitude*. Its maximum value corresponds to a rotation through $7^\circ 45'$.

Further, the axis of rotation of the moon is not exactly perpendicular to the plane of her orbit; hence the two poles of rotation, and those parts of her surface which are near these poles, are alternately visible from the earth. This is called the *Libration in Latitude*. Its maximum value amounts to $6^\circ 44'$.

Again, the observer is not placed at the center of the earth, but at its surface. Thus in the course of a day the moon appears to oscillate about her radius vector because of the earth's rotation. This phenomenon constitutes what is called the *Diurnal Libration*, and is evidently the effect of the lunar parallax, and corresponds to it in amount, measured in minutes of arc. It therefore never exceeds $1^\circ 1' 28''.8$.

The libration in latitude and the diurnal libration were discovered by Galileo soon after the invention of the telescope. It was Hevelius who discovered and first explained the libration in longitude.

The coincidence of the nodes of the lunar equator and orbit ranks among the most curious discoveries of modern astronomy. It was shown by Lagrange to be a necessary consequence of the attraction which the earth exercises on the lunar spheroid.

The various features of the moon's surface have been observed with great interest since the discovery of the telescope, and astronomers have been at much pains to determine their selenographic positions. On account of their number, it has been found necessary to distinguish them by particular names. Riccioli designated the most conspicuous of them by the names of astronomers and

other eminent men. Hevelius gave them the names belonging to countries, islands, seas, and regions on the earth, without reference to situation or figure. The nomenclature of Riccioli is now universally followed. Delineations of the lunar disk have been given by Hevelius, in his *Selenographia*, by Cassini, Russell, Schröter, Lohrmann, and others.

That there are great inequalities on the surface of the moon is proved by looking at her through a telescope at any other time than when she is full; for then there is no regular line bounding the dark and illuminated parts, but the confines of these parts appear as it were toothed and cut with innumerable notches and breaks; and even in the dark part, near the borders of the enlightened surface, there are seen some small spaces illuminated by the sun's beams. It is impossible that this should be the case, unless these shining points were higher than the rest of the surface, so that the rays of the sun may illumine their summits before they reach their basis. Portions of considerable extent are also perceived on the lunar surface, which are never brilliant like the other parts, but remain constantly obscure. These are thought by some to be old sea-bottoms; they were formerly supposed to be seas, but this idea has been abandoned. Some of these cavities are upward of four English miles in depth, and forty in circumference at the orifice. An insulated mountain is frequently observed to rise in the center of these enormous pits or caverns, and they are surrounded by high annular ridges, the masses of which would fill the inclosed cavities. Herschel imagined that he even observed volcanoes in activity; but it is now known that he mistook for volcanic light the effects of earth-light reflected from those parts of the moon's surface which have the highest reflective capacity.

ECLIPSES.

Strictly speaking, the term eclipse extends to all cases in which one celestial body is wholly or partially obscured by another, either by direct intervention or by the interception of light illuminating the former, so that the term includes transits of inferior planets, the concealment of stars by the moon or by a planet, or the concealment of a satellite by its primary. But the term eclipse is for convenience limited to the three following orders of phenomena: (1) The total or partial concealment of the sun by the moon, called a *solar eclipse*. (2) The obscuration of the moon by the shadow of the earth, called a *lunar eclipse*. (3) The concealment of a satellite of a planet by the shadow of the primary, called *eclipses of satellites*, and distinguished from *occultations* in which the *disk* of the primary hides the satellite from view.

Solar and lunar eclipses can be considered together, so far as the general law of their sequence is concerned. From what has been already shown, it follows that, if the motions of the sun and moon could be watched continuously from the center of the earth, the moon would be seen to pass round the star-sphere once in each sidereal month on a path inclined about $5^\circ 8'$ to the ecliptic, while the sun would complete the circuit of the ecliptic once in a sidereal year; and the moon would pass the sun's place once in each synodical month. The place of conjunction of the sun and moon would clearly pass round the star-sphere, advancingly, making the complete circuit of the heavens once in each year on the average; and the same would happen with the place of conjunction of the moon and the point directly opposite the sun. Moreover, as the moon at these conjunctions would, of course, be on her own apparent orbit, and that orbit is inclined to the sun's, it is clear that, supposing the moon's orbit fixed, the conjunction of sun and moon during one-half of the year would

occur with the moon in the northern half of her apparent orbit, and those in the other half would occur with the moon in the southern half of her orbit. The same would be true of the conjunctions of the moon with the point opposite the sun, only, of course, the halves of the lunar orbit would be interchanged. At or near the time when the place of either conjunction was crossing from the northern to the southern side of the moon's orbit, or *vice versa*, the conjunction would occur with the moon so near to the ecliptic, that if the conjunction were one of sun and moon, she would hide the sun's disk wholly or partially, while, if the conjunction were one of the moon with that point opposite the sun toward which the earth's shadow is thrown, she would enter that shadow wholly or partially. In other words, at two seasons separated by six months there would be eclipses of the sun or moon, or both, whereas during the intervening months no eclipses would occur.

The number of eclipses which could occur in either eclipse-season would depend on the rate at which the points of successive conjunction approached and left the ecliptic, on the proximity necessary for the occurrence of an eclipse of either sort, and also on the manner in which the lunar node happened to be passed. For example, suppose that a conjunction of the sun and moon occurred when the moon was exactly at a node, so that a central eclipse of the sun occurred; then, half a synodical month before and half a synodical month after that conjunction, there would be a conjunction of the moon with the point opposite the sun, and the moon being only half a month's journey from her node, would be at a point of her orbit not far from the ecliptic. But the extent of the earth's shadow is such, that the moon would only be partially in the penumbra, and penumbral lunar eclipses are not considered by astronomers. There would therefore be only one eclipse in such an eclipse-season, viz., a central solar eclipse. Next, suppose that when the moon was at her node, she was exactly opposite the sun, then there would be a total lunar eclipse. Half a lunation later and earlier she would be in conjunction with the sun, and she would be at a point of her orbit not far from the ecliptic. In this case, although during half a month from nodal passage, the moon, supposed to be viewed from the earth's center, gets to a distance from the ecliptic exceeding the sum of her own and the sun's semidiameters, and therefore *so viewed* would pass clear of the sun, yet for the earth, regarded as a whole, she would not pass quite clear of the sun. In this case, then, there would be three eclipses, one lunar and total, the other two solar and partial. These results would be approximated to if the conjunction of sun and moon in the first case, or of moon and sun-shadow in the second case, occurred with the moon very near a node. But otherwise there would be an eclipse either solar or lunar a few days before her nodal passage, and another either lunar or solar a few days after her nodal passage, and no other eclipse of either sort in that eclipse-season.

All this corresponds to the actual conditions except in one respect. The lunar nodes retrograde, so as to meet the advancing conjunction-points of either kind; and thus, instead of a year being occupied in the complete circuit of the conjunctions, the actual interval has for its mean value the mean interval between the successive conjunctions of the sun with the rising node of the moon's orbit, or 346.607 days. Accordingly, the average interval between successive eclipse-seasons is 173.3 days instead of half a sidereal year.

Noting that eclipse-seasons last on the average about thirty-three days, and that three eclipse-seasons each having three eclipses cannot occur in succession, it is easy to determine the greatest and least number of

eclipses which may occur in any single year. The average interval between successive eclipse-seasons is 173.3 days. Two such intervals amount together to 346.6 days, or fall short of a year by about nineteen days. Hence there cannot be three eclipse-seasons in a year; for each eclipse-season lasts on the average thirty-three days. But there may be two seasons, each containing three eclipses, followed by a season containing two eclipses, only one of which can occur in the portion of the eclipse-season falling within the same year. In this case there would be seven eclipses in the year. So also there would be seven if in the first season there were three, in the second two, and in the third three, for then the portion of the third falling within the year, being rather more than one-half, would comprise two eclipses. So also if the three successive seasons comprise severally two, three, and three eclipses.

There may then be as many as seven eclipses in a year, in which case at least four eclipses will be solar, and at least three of these partial, while of the lunar eclipses two at least will be total.

As regards the least possible number of eclipses, it is obvious that, as there must be two eclipse-seasons in the year, and at least one eclipse in each, we cannot have less than two eclipses in the course of a year. When there are only two, each eclipse is solar and central.

THE PLANET MARS.

After Venus, Mars is the planet whose orbit is nearest to the earth. His diameter is about 4,400 miles, and his volume about one-sixth of the earth's; his mass, however, is little more than one-ninth of hers, his density being estimated at only seven-tenths of the earth's. His mean distance from the sun is about 139,000,000 miles; but the eccentricity of his orbit amounting to 0.093262, his greatest and least distances differ considerably from this mean value, amounting to 152,304,000 and 126,318,000 miles respectively. It follows that his distance from the earth when in opposition varies largely—in opposition near his perihelion his distance is about 33,800,000 miles, whereas, when he is near aphelion, his opposition distance amounts to 61,800,000 miles. As he is also more brightly illuminated by the sun when in perihelion, it follows that he appears much brighter when in opposition at that part of his orbit.

In other words, the planet is nearly five times as bright at one of the favorable oppositions as at one of the unfavorable. The planet's synodical period being 779.936 days, or two years and about 49½ days, it follows that the place of opposition performs a complete circuit of the ecliptic in an average period of rather more than seven times the synodical period, so that the change in the place of opposition nearly corresponds to the earth's yearly motion. It is said that Fontana first noted the spots of Mars, and suspected the planet's rotation. But Fontana's credit is shaken by his alleged discovery of *seven* Jovian satellites. Cassini observed the spots at Bologna in 1666, and having continued his observations for a month, determined the planet's rotation-period as 24 h. 40 m. Cassini in 1670 again observed the planet, obtaining the same rotation-period as before. Maraldi in 1704 noted changes in the shape of the spots; but from some which underwent little change, he deduced the rotation-period 24 h. 39 m. In 1719, when Mars was exceedingly well placed for observation, Maraldi again carefully observed the planet, deducing from the observations of thirty-seven days a rotation-period identical with Cassini's.

Besides the dark spots, which have a somewhat greenish color, the rest of the disk being mostly ruddy, astronomers had noticed a portion of the disk around the south pole which was brightly white. The bright

appearance so remarkable about the poles of Mars was ascribed by Herschel to the reflection of light from mountains of ice and snow accumulated in those regions.

ASTERIODS.

On the first day of the present century a new planet was discovered, which, although in one sense seeming to fill up a gap in the solar system, was yet unlike any hitherto known member of the planetary family. Kepler and Titius, followed in later times by Bode, had adopted the view that a planet was wanting to complete the symmetry of the solar system, as indicated by a certain law of progression in the planetary distances. Toward the close of the last century, when Uranus had but lately been discovered and found to obey the law of distances, it was natural that the attention of astronomers should be directed to the strange gap in the series between Mars and Jupiter. So great was the confidence with which many now regarded the law, that the theory was advanced that a planet invisible to the naked eye was traveling within the seemingly vacant space; and through the exertions of Baron de Zach, an association of twenty-four astronomers was formed to search the zodiac for the unseen planet. Yet the discovery was not made by any member of this society. Wollaston had laid down a star in his catalogue where no star could be seen. Piazzi carefully examined the neighborhood, to determine whether some star really existing there had been misplaced by Wollaston. On January 1, 1801, he noted a small star in Taurus, which on January 3 had changed its place. He wrote to Oriani and Bode; but the planet, which was at its stationary point, following opposition, on January 12, had become invisible owing to its approach to the sun, before the letter reached them, and Piazzi himself fell ill soon after. But Gauss, the eminent mathematician, undertook to compute the new planet's orbit and motions from the observations made by Piazzi, and at length, after long searching, De Zach rediscovered the planet on December 3, 1801, Olbers independently discovering it on the following evening. Piazzi gave to the new planet the name Ceres. Besides differing from the other known planets in being so small as apparently to belong to a different order, Ceres was found to have an inclination (of more than $10\frac{1}{2}^\circ$) exceeding largely even that of Mercury. But these anomalous relations were soon found to be but the first indications of a discovery altogether more remarkable.

During his long and arduous search for Ceres, Dr. Olbers of Bremen had had occasion to examine with peculiar care the stars near her path. On March 28, 1802, he observed a star near Bode's stars 20 and 191 Virginis, where he felt sure that no star had existed during his former observations. After two hours it had moved very much as Ceres had done when he had first seen her almost in the same spot. Subsequent observations showed that this was a small planet (to which the name Pallas was given) traveling in an orbit having a mean distance of about 2.770 (earth's as 1), slightly exceeding, therefore, that of Ceres, but with an eccentricity of .248, considerably exceeding that of any known planet, and an inclination of $34^\circ 39'$, exceeding the sum of the inclinations of all the other planets together. The effect of this great inclination on the geocentric position of the planet is even more remarkable than the heliocentric range of more than 69° in latitude. For when Pallas is at her greatest heliocentric latitude, and near opposition, her geocentric latitude exceeds 42° . This is very different from Venus's range of less than 9° in geocentric latitude, which had been regarded as the maximum, and had led astronomers to assign to the zodiac a breadth of 18° . A zodiac to include the asteroids should be 90°

in breadth, and would cover seven-tenths of the whole heavens.

While Harding of Lilienthal was charting the stars near the paths of Ceres and Pallas in the region thus indicated, he determined, on September 2, 1804, the position of a small star in Pisces, near 93 and 98 of Bode's catalogue. On September 4 the star was no longer in the same position. It was found to be a planet (to which the name Juno was given) traveling at a mean distance of 2.67 (considerably less than that deduced for Ceres and Pallas), in an orbit having eccentricity 0.257, and inclination $13^\circ 1'$. The effect of this great eccentricity is remarkable, as may be thus indicated—supposing the apsides of the orbit to correspond to the planet's solstices, then the summer of one hemisphere is only half as long as the winter of that hemisphere, or as the summer of the other.

Next Olbers, pursuing the same method, discovered Vesta, moving in an orbit having mean distance 2.373 (far less even than Juno's), eccentricity 0.0898, and inclination $7^\circ 71'$.

A long interval then elapsed without the discovery of any new members of this remarkable family. It was not until December 8, 1845, that the fifth was recognized. On that night M. Hencke, an amateur astronomer of Driessen, discovered the body since named Astræa. He communicated his discovery to Encke and Schumacher, who confirmed it by observations made with more powerful telescopes. M. Hencke also discovered the sixth planet, on July 1, 1847. Since that time not a year has passed without the discovery of one or more minor planets; and in some years as many as ten or twelve have been added.

JUPITER AND SATURN.

Jupiter is the largest planet of the solar system. Indeed he surpasses the rest so greatly, that the combined mass of all of them together would barely exceed two-fifths of his. This superiority is deserving of more consideration than it has commonly received. If we are justified in regarding our moon or the asteroids as belonging to a different order of bodies from the earth, Venus, Mars, and Mercury, because so much less than them in mass, we may not unreasonably regard Jupiter as belonging to a different order, because so much exceeding in mass the planets which travel within the zone of asteroids. The earth exceeds the moon only eighty-one times in mass, but Jupiter exceeds the earth in mass more than 300 times.

Jupiter travels at a distance from the sun exceeding the earth's five and one-fifth times, or at a mean distance of 475,692,000 miles. The eccentricity of his orbit is considerable, amounting to 0.048239, so that his greatest and least distances amount respectively to 498,639,000 miles and 452,745,000 miles. When in opposition, and at his mean distance, his distance from the earth amounts to about 361,000,000 miles. His orbit is inclined about $1^\circ 18' 40.3''$ to the ecliptic. His sidereal revolution is completed in 4332.5848 days, or 11 years 314.92 days; whence it is easily calculated that his synodical period, or the interval separating his mean returns to opposition, has a mean value of 398.867 days. His mean diameter is nearly 85,000 miles in length. His volume exceeds the earth's 1233.205 times, but his density is only about one-fourth of hers, and his mass does not exceed hers more than 301 times.

Although the actual order of discovery would lead us to speak of the satellites of Jupiter before considering the features of his globe, it will be for several reasons more convenient to describe these features first. Cassini was the first to discover that Jupiter's globe is surrounded by belts apparently belonging to his surface. The features of these belts, as described by Cassini, are

those which still continue to be recognized. Their number is variable; sometimes only one can be readily discerned, while at others the whole surface is covered by them. They are generally parallel to one another, but not always so. Their breadth is likewise variable, one belt having been observed to grow narrow, while another in its neighborhood has increased in breadth, as if one had partially flowed into the other; and in this case a part of an oblique belt is commonly recognized between them, as if forming the channel of communication. Sometimes the belts remain unchanged for months; at others, new belts have formed in an hour or two. Although his surface appears thus variable, yet at times spots have been visible for several weeks, whose motions have served to indicate the law of the planet's rotation.

In 1665 Cassini observed a spot near the large central belt of Jupiter. It moved more quickly when near the middle of the disk than when near the edge, and also appeared narrower when at the edge, showing that it belonged to the surface (that is, to what appears as the surface) of the planet. This principal or ancient spot, as it is called, is the largest and most permanent of any yet discovered. It appeared and vanished eight times between the years 1665 and 1708, then continuing invisible till 1713. The spot has been frequently observed since, sometimes remaining visible for two or three years in succession, at others being unseen for as long or longer.

The equator of Jupiter is inclined only $3^{\circ} 5' 30''$ to the planet's orbit, so that there can be no appreciable seasonal changes. We should expect, therefore, a great calm to reign in the atmosphere of this planet, the more so that the sun's heat poured upon each square mile of it is (on the average) less than the 27th part of that received by each square mile of the earth's surface. Moreover, the seasons of Jupiter last nearly twelve times as long as ours, so that we should expect all changes in his atmosphere produced by solar action to take place with exceeding slowness.

Soon after the invention of the telescope, Galileo discovered that four small orbs or satellites circle around Jupiter. Galileo soon found that their orbits are nearly circular, and their motions nearly uniform. They revolve in planes inclined little to the plane of the ecliptic, so that as viewed from the earth they appear to traverse very narrow ellipses.

Saturn is the largest planet but one of the solar system, being surpassed in mass by Jupiter alone. His mass exceeds the combined mass of all the other planets (Jupiter excepted) nearly three fold. He is the sixth planet in order of distance from the sun, and was the remotest planet known to the ancients. He travels at a mean distance of 872,137,000 miles from the sun, his greatest distance being 920,973,000 miles, his least distance 823,301,000 miles. The eccentricity of his orbit is 0.055996, and the inclination $2^{\circ} 29' 28''$ to the plane of the ecliptic. Saturn's mean sidereal period of revolution in his orbit is 29 years 167 days (see the *Elements*, p. 782); his mean synodical revolution, or the mean interval between his successive returns to opposition, is 378.090 days. The planet's mean diameter is about 70,000 miles, his polar diameter about 3,500 miles less, his equatorial diameter about 3,500 miles greater. In volume he exceeds the earth nearly 700 times, but in mass only about 90 times, his density being less than the earth's in the proportion of about 13 to 100. He rotates on his axis in about $10\frac{1}{2}$ hours, the plane of his equator being inclined nearly 27° to the plane of his orbit.

This planet, in consequence of a luminous ring with which he is surrounded, is one of the most interesting objects in the heavens. This singular appendage was first noticed by Galileo, to whom the planet presented

a triple appearance, as if a large orb were situated between two small bodies or *ansæ*. He observed that sometimes the *ansæ* were so enlarged as to present the appearance of a continuous ring; at other times they entirely disappeared, and Saturn appeared round like the rest of the planets. After a certain time they again became visible, and gradually increased in magnitude. These curious appearances were shown by Huyghens to be occasioned by an opaque, thin, circular ring surrounding the equator of Saturn, and at a considerable distance from the planet. Saturn moving in the plane of his orbit, carries the ring along with him, which, presenting itself to the earth under different inclinations, occasions all the phenomena which have been described.

Among the most remarkable discoveries of recent times with regard to the rings of Saturn is that of the *inner dusky or semi-transparent ring*, sufficiently obvious to any observer capable of using well a moderately good telescope, but which, previously to the year 1850, was only once mentioned by any astronomer. Dr. Galle of Berlin saw this ring with the Berlin refractor in 1838, but the attention of the scientific world was not generally drawn to it. The account of Galle's observations is accompanied by drawings exhibiting the trace of the dusky ring where it crosses the body of the planet. In the year 1850 the ring was recognized almost simultaneously by two observers, namely, by Prof. Bond of the Cambridge Observatory, U. S., and by Mr. Dawes. Since that time there has been no difficulty in seeing this appendage, though it requires a practiced eye and a good telescope. The opinion now generally entertained respecting the Saturnian ring-system is, that it is composed of multitudes of minute satellites, probably intermixed with vapor, traveling independently around the planet. On no other supposition, indeed, can the permanence of the ring-system be explained.

From observations of some obscure belts, and a very conspicuous spot on the surface of Saturn, Sir W. Herschel concluded that his rotation is performed in 10 hours 16 min. He also observed that the globe of Saturn appeared to be flattened at the equator as well as at the poles.

Saturn is surrounded by a system of eight satellites—the most extended as well as most numerous subordinate system within the sun's domain. The span of the orbit of the outermost satellite amounts to nearly four millions of miles. This satellite is probably larger than our moon, while Titan, the 6th satellite, is nearly as large as the planet Mercury.

URANUS AND NEPTUNE.

Uranus is the seventh primary planet in order of distance from the sun, and, with the exception of Neptune, the remotest. His mean distance from the sun exceeds the earth's more than nineteen times, and amounts to 1,753,869,000 miles. But the eccentricity of the orbit is considerable, amounting to 0.0466; consequently, the variation of the planet's distance is also great, his greatest distance amounting to 1,835,561,000 miles, his least to 1,672,177,000 miles. The sidereal revolution of Uranus is performed in 30,686 days, or 84 years $6\frac{1}{2}$ days. His mean diameter is about 33,000 miles. The apparent diameter of the sun seen from Uranus is less than $\frac{1}{16}$ th of the diameter of the sun as we see him, or is but about $1\frac{1}{2}''$; and the apparent surface of the sun is but about the 367th part of the apparent surface of the sun we see. Accordingly, the light and heat received by Uranus are less in the same proportion. It has been asserted that Uranus turns upon an axis in about $9\frac{1}{2}$ hours, but the evidence on which this statement rests is slight and insufficient.

Uranus was discovered by Sir W. Herschel on March 13, 1781, while he was examining the small stars in the neighborhood of Geminorum. Being struck with the enormous magnitude of a star in this region, he suspected it to be a comet. He examined it with higher power, and found the disk enlarged, which would not be the case with a star. He therefore announced the discovery of a comet. But it was found to be moving in a nearly circular path, and was presently recognized as one of the principal planets of the solar system. Herschel gave it the name of *Georgium Sidus*, and foreign astronomers called it *Herschel*, but the name *Uranus*, suggested by Bode, of Berlin, is now universally adopted. In 1787 Herschel discovered that it was attended by two satellites, and he subsequently supposed that he had discovered four others; but there is great reason to believe that he had mistaken small stars near the planet for satellites. Two other satellites inferior to the rest have been discovered by Mr. W. Lassell, completing the series of four satellites.

Little of interest has rewarded the telescopic study of Uranus; nor has the spectroscope given any trustworthy evidence, though Secchi, Huggins, and Vogel recognize peculiarities distinguishing the spectrum of Uranus from that due to reflected sun-light.

The discovery of the planet Neptune ranks amongst the most brilliant of the scientific feats of the present century.

For many years the orbit of Uranus had been the occasion of great embarrassment to astronomers, from the impossibility of adequately reconciling the ancient and modern observations by any one set of elements, and from the rapid increase of the error from year to year. Bouvard early suggested that some planet exterior to Uranus caused these apparent irregularities. Among the astronomers who entered seriously upon the task of determining the position of such a disturbing planet two arrived at a successful solution of the problem, namely, Mr. Adams and M. Leverrier.

Almost immediately after the discovery of Neptune, it was found to be attended by one satellite. This discovery was made by Mr. Lassell in October, 1846. The orbit of the satellite is inclined to the ecliptic at an angle of about 29° .

COMETS AND METEORS.

The comets form a class of bodies belonging to the solar system, distinguished from the planets by their physical appearance and the great eccentricities of their orbits.

While the orbits of all the planets are confined within a narrow zone, or to planes not greatly inclined to the ecliptic, those of the comets are inclined in all possible angles. They have received the name of comets (*coma*, hair) from the *bearded* appearance which they frequently exhibit.

One of the most remarkable periodic comets with which we are acquainted is that known to astronomers as Halley's. Having perceived that the elements of the comet of 1682 were nearly the same as those of two comets which had respectively appeared in 1531 and 1607, he concluded that all the three orbits belonged to the same comet, of which the periodic time was about 76 years. After a rough estimate of the perturbations it must sustain from the attraction of the planets, Halley predicted its return for 1757—a bold prediction at that time, but justified by the event, for the comet again made its appearance as was expected, though it did not pass through its perihelion till the month of March, 1759, the attraction of Jupiter and Saturn having caused, as was computed by Clairaut previously to its return, a retardation of 618 days. This comet had been observed in 1066, and the accounts which have

been preserved represent it as having then appeared to be four times the size of Venus, and to have shone with a light equal to a fourth of that of the moon. History is silent respecting it from that time till the year 1456, when it passed very near to the earth; its tail then extended over 60° of the heavens, and had the form of a saber. It returned to its perihelion in 1835, and the splendor of its appearance rendered it once more an object of universal interest; it was well observed in almost every observatory.

Another famous comet, whose periodic returns have been verified by observation, received the name of Encke, the astronomer who first recognized it as having been observed in previous revolutions. It returns to its perihelion in 1,208 days. Encke's comet, although its identity was not discovered till 1818, had been frequently observed, as in 1789, 1795 and 1805; and on these occasions it exhibited very different appearances, having been seen with and without a nucleus, and with and without a tail—circumstances which account for its having so long escaped being recognized as a regular attendant on the sun.

The appearances exhibited by comets are diversified, and sometimes remarkable. That which appeared in the year 134 B.C., at the birth of Mithridates, is said to have had a disk equal in magnitude to that of the sun. Ten years before this, one was seen which, according to Justin, occupied a fourth part of the sky (that is, extended over 45°), and surpassed the sun in splendor. Another, equally remarkable, appeared in the year 117 of our era; and in 479 there was one, of which the disk, according to Freret, was of such magnitude, that it might have occasioned the extraordinary eclipse of the sun which took place about that time. In 400 one was observed, which is said to have resembled a sword, and to have extended from the zenith to the horizon. That of 531 was of greater magnitude still, and its appearance more terrific. Those which appeared in 1066 and 1505 exhibited disks larger than that of the moon. It is, however, probable that these accounts were exaggerated; for since comets have been observed by astronomers, no instances have occurred in which their magnitudes and appearances have been so extraordinary. The most remarkable among those of which we possess accurate accounts appeared in the years 1456, 1618, 1680, 1744, 1759, 1769, 1807, 1811, 1841, 1858, 1861 and 1874.

It is only of late years that the study of meteors or falling stars has come to be regarded as belonging to astronomy. Even now the discovery of the connection of meteors and comets is so recent, and the aspect under which the new department of astronomy presents itself varies so continually as fresh relations are recognized, that it seems desirable to limit our remarks to the statement of a few broad facts. It has been shown, then, that meteors travel in systems round the sun, and that displays of falling stars occur when the earth passes through a meteor-system.

There are already recognized more than one hundred meteor-systems, known by the direction in which the corresponding falling stars encounter the earth.

The best-known meteor-systems are those which produce a shower on November 13-14 in certain years, and those which usually produce a display on August 10-11. The former have been called the *Leonides*, because the part of the stellar sphere whence the meteors appear to radiate is in the constellation Leo. The latter, for a like reason, appearing to radiate from Perseus, have been called the *Perseides*.

The great multitude of stars visible even to the naked eye renders it impossible to distinguish each by a particular name; astronomers, accordingly, for the sake of

reference, have formed them into groups, known as *Constellations* or *Asterisms*. To these the early astronomers gave the names of men and animals and other objects from fancied resemblances or analogies, for the most part not easily traced. These denominations are preserved in modern catalogues, and the practice of delineating the object itself on celestial globes and charts has been only recently, if it has yet been altogether abandoned. The ancients distinguished some of the brightest stars in the different constellations by particular names; but to include others less conspicuous, it became necessary to adopt a different mode of proceeding. According to the usual method, first introduced by Bayer in his *Uranometria*, each of the stars in every constellation is marked by a letter of the Greek alphabet.

ASTURIAS, one of the ancient provinces of Spain, formerly (from 1388 downwards) conferred as a principality on the heir-apparent to the throne. By the new division of Spain in 1833, the province took the name of Oviedo, though not to the exclusion, in ordinary usage, of the older designation. It is bounded on the N. by the Bay of Biscay, on the S. by Leon, on the W. by Galicia, and on the E. by Santander, which is now incorporated with Old Castile. It consists of a portion of the northern slope of what is properly a part of the Pyrenean system, and is covered in all directions with offshoots from the main chain, by which it is almost completely shut in on all sides. Only a few of the passes across the mountains are practicable for carriages, and most of them are difficult even for horses. Along the coast there is a narrow strip of level ground, which consists largely of bare and moor-like reaches, covered with furze. The province, as might be supposed, is watered by numerous streams and rivers, which have hollowed out beautiful and picturesque valleys; but owing to the narrowness of the level tract, their courses are short, rapid, and subject to floods. The most important is the Nalon or Pravia, which receives the waters of the Caudal, the Trubia, and the Narcea, and has a course of 62 miles; after it rank the Navia and the Sella. Along the whole extent of the coast, a distance of 130 miles, there is not one good port. In that of Riba de Sella a large frigate may anchor, and Gijon will admit a vessel drawing 16 or 17 feet of water; but the entrance is in both cases difficult and dangerous. The climate of the district is generally mild, but overcharged with humidity, and in the higher regions the winters are protracted and severe. The broken character of the surface prevents anything like extensive agricultural industry, but abundant pasturage is found in the valleys. The wheat crop frequently fails. Rye succeeds better, and is often mixed with the maize which forms the principal food of all but the higher classes. Chestnuts—here, as elsewhere in Spain, an important article of diet—are very abundant on the hills, and the tree supplies valuable timber. Other timber-trees, such as oak and beech, are found in the mountains, along with various medicinal plants, such as hellebore, angelica, and valerian. Apples are abundant, and cider forms the common drink of the people; but little attention is paid to vines. The horses of Asturias are specially gentle and sure-footed, ranking among the best in Spain, and excelling those of Andalusia in strength, though surpassed by them in beauty. Wild deer, boars, and bears are not uncommon among the mountains; and the sea-coasts, as well as the streams, abound with fish of various kinds, including salmon and lampreys, which are sent to the markets of Madrid.

The capital of the province is Oviedo, and the other towns of importance are Gijon, Aviles, Llanes and Luarca.

ASUNCION, or ASSUMPTION, the capital of the Republic of Paraguay in South America. It is situated in the midst of a fertile territory on the eastern bank of the River Paraguay (here upwards of 600 yards in width), about 18 miles above the most northerly mouth of the Pilcomayo. It was one of the earlier Spanish settlements in this part of America, being founded in 1535 by Gonzalo de Mendoza and Juan de Salazar y Espinosa, and receiving its name of *Nuestra Señora de la Asuncion*, in honor of the festival of the Assumption. Originally a small fort, it soon became, from the convenience of its situation, a town of considerable importance, and in 1547 was erected into a bishopric. Formerly, while the Jesuits were masters of the country, it consisted of a rather irregular assemblage of one story houses, relieved by ecclesiastical buildings of varying pretension, from the cathedral downwards; but under the dictatorship of Francia, the streets were more symmetrically arranged, and a number of secular buildings erected. These were greatly increased under the rule of his successors, and Asuncion was brought into similarity with a European city of corresponding rank, having its government house, its president's palace, its arsenal, custom-house, barracks, military hospital, theater, and railway station. While the war between Paraguay and the neighboring states lasted, Asuncion suffered greatly, being taken and plundered in 1869 by the Brazilian forces, who had already bombarded it from the river. The population, Spanish for the most part in language, but of various races, was estimated, late in 1896, at 45,000, and carried on a somewhat extensive trade in Paraguay tea, or *Yerba Maté*, hides, tobacco, fruits, molasses, and rum.

ASYLUM, in *Greek Antiquities*, a temple enclosure, within which protection from bodily harm was afforded to all who sought it and could prove their danger. In a general sense, all Greek temples and altars were *asyla*, that is, it was a religious crime to remove by force any person or thing once under the protection of the deity. But it was only in the case of a small number of temples that this protecting right of a deity was recognised with common consent, and, apparently, these were among the oldest temples of Greece. Such, for example, was the temple of Athena Alea at Tegea in Arcadia, where King Pausanias II. spent the remainder of his days after the battle of Haliartus; or the temple of Ganymeda (Hebe) at Philus, where, it is said, persons who had escaped from prison hung up their chains in the sacred grove. Other instances are the sanctuaries of Poseidon at Calauria and Tænarum, of Athena at Chalcioecus at Sparta, and of Amphiaraus at Oropus.

ASYLUM, a term now usually applied to homes for lunatics and idiots, deaf mutes and the blind. The word is used in some cases as a synonym for a refuge, for a sheltering place for orphans.

ASYMPTOTE (Gr. not coinciding), a line that continually approaches nearer and nearer to some curve, but only meets it at an infinite distance.

ATACAMA, a district of South America. (1.) The Chilean province has an area of about 28,400 square miles, with a population of 60,000. It is bounded S. by the province of Coquimbo, W. by the Pacific, and E. by the Argentine Republic. It is one of the richest copper and silver districts in the world, nearly 1000 mines being worked for the former metal, and about 250 for the latter. The silver ore was first discovered in 1832, by a shepherd, Juan Godoy, at a place which has since been occupied by a village that bears his name. The ores of lead and zinc are frequently found, and sulphur, alum, and salt are all of them abundant, the deposit of the last article alone covering about 50 square miles at the Laguna Salada. Gold likewise occurs in sufficient quantity to be mentioned in the list of exports.

The capital of the province is Copiapo, with 13,380 inhabitants, and the population is principally clustered in the valleys of Copiapo and Huasco, and in the neighborhood of the various mines. Caldera is the principal port, and is connected with the capital and the eastern districts by the first railway constructed in South America. The value of the mineral exports through this and the adjacent ports was in 1889 estimated at 6,218,275 dollars. (2.) The Bolivian department has an area of about 70,000 square miles, with a population of about 18,000, which is rapidly increasing. It also owes its prosperity almost solely to its wealth in copper and silver. The mines of Caracoles, recently discovered, are said to be the most productive silver mines in the world. In other products it coincides with the Chilean province, with the addition, however, of meteoric iron, which has been found in remarkable masses. A large part of what is more especially designated the Desert of Atacama is included in the department. It is not, as the name might suggest, a sandy, but for the most part a rocky and rugged, tract, with the merest patches and strips of vegetation. The capital of the department is Cobija, or, as it is officially called, Puerto de la Mar; but its prosperity is in some degree threatened by the rise of Mejillones, a seaport which has recently been connected by railway with the principal mining districts. See Phillippi, *Reise durch die Wüste Atacama*, Halle, 1860; Tchudi, *Reise durch die Andes*, a supplement to Petermann's *Mittheil.*, 1860; *Journ. Roy. Geog. Soc.* 1851, 1855.

ATAHUALLPA (*atahu*, Latin *virtus*, and *allpa*, sweet), called the last of the Incas, was the son of Huayna Capac, eleventh Inca of Peru, by the daughter of the conquered sovereign of Quito. His brother Huascar succeeded Huayna Capac; for, as Atahualpa was not descended on both sides from the line of Incas, Peruvian law considered him illegitimate. He obtained, however, the kingdom of Quito, whether by stratagem or not is uncertain. A jealous feeling soon sprang up between him and Huascar, who insisted that Quito should be held as a dependent province of his empire. A civil war broke out between the brothers, and, though the details of it are not accurately known, it appears that just about the time when Pizarro was beginning to move inland from the town of San Miguel, Huascar had been defeated and thrown into prison, and Atahualpa had become Inca. Pizarro set out in September, 1532, and made for Cassamarca, where the Inca was. Messengers passed frequently between them, and the Spaniards on their march were hospitably received by the inhabitants. On the 15th November, Pizarro entered Cassamarca, and sent his brother and Fernando de Soto to request an interview with the Inca. On the evening of the next day, Atahualpa entered the great square of Cassamarca, accompanied by some five or six thousand men, who were either unarmed, or armed only with short clubs and slings concealed under their dresses. Pizarro's artillery and soldiers were planted in readiness in the streets opening off the square. The interview was carried on by the priest Vicente de Valverde, who addressed the Inca through an interpreter. He stated briefly and dogmatically the principal points of the Christian faith and the Roman Catholic policy, and concluded by calling upon Atahualpa to become a Christian, obey the commands of the Pope, give up the administration of his kingdom, and pay tribute to Charles V., to whom had been granted the conquest of these lands. To this extraordinary harangue, which from its own nature and the faults of the interpreter must have been completely unintelligible, the Inca at first returned a very temperate answer. He pointed out what seemed to him certain

difficulties in the Christian religion, and declined to accept as monarch of his dominions this Charles, of whom he knew nothing. He then took a Bible from the priest's hands, and, after looking at it, threw it violently from him, and began a more impassioned speech, in which he exposed the designs of the Spaniards, and upbraided them with the cruelties they had perpetrated. The priest retired, and Pizarro at once gave the signal for attack. The Spaniards rushed out suddenly, and the Peruvians, astonished and defenceless, were cut down in hundreds. Pizarro himself seized the Inca, and in endeavoring to preserve him alive, received, accidentally, on his hand the only wound inflicted that day on a Spaniard. Atahualpa, thus treacherously captured, offered an enormous sum of money as a ransom, and fulfilled his engagement; but Pizarro still detained him, until the Spaniards should have arrived in sufficient numbers to secure the country. While in captivity, Atahualpa gave secret orders for the assassination of his brother Huascar, and also endeavored to raise an army to expel the invaders. His plans were betrayed, and Pizarro at once brought him to trial. He was condemned to death, and, as being an idolater, to death by fire. Atahualpa, however, professed himself a Christian, received baptism, and his sentence was then altered into death by strangulation. His body was afterwards burned, and the ashed conveyed to Quito. From the reports of the Spanish historians, it is impossible to gain an accurate idea of the character and abilities of the Peruvian monarch, and we have no other notices by which to test their account.

ATALANTA, in *Greek Legend*, (1) was connected with Arcadia, where, at her birth, she had been exposed on a hill, her father Jason having expected a son. At first she was suckled by a she-bear, and then saved by huntsmen, among whom she grew up to be skilled with the bow, swift, and fond of the chase, like the virgin goddess Artemis. At the hunt of the Calydonian boar her arrows were the first to hit the monster, for which its head and hide were given her by Meleager. At the funeral games of Pelias, she wrestled with Peleus, and won. Melanion, with intense love, followed, fought, and toiled in her service, she despising love, and remaining true to Artemis long, but yielding at last. She was the mother of Parthenopæus. But there was (2) another Atalanta in *Æolian legends*, who was to be obtained in marriage only by him who could outstrip her in a race, the consequence of failure being death. Hippomenes, before starting, had obtained from Aphrodite three golden apples, which at intervals in the race he dropped, and Atalanta, stopping to pick them up, fell behind. Both were happy at the result; but forgetting to thank the goddess for the apples, they were led by her to a religious crime, and for this were transformed into lions. Latterly the adventures of these two separate heroines were united and told as of one.

ATAXY, LOCOMOTOR (*a priv.*, *τάξις* order—Synonyms, *Progressive locomotor ataxy*, *Tabes dorsalis*, *Posterior spinal sclerosis*), a disease of the nervous system, manifesting itself principally by disordered movements of the limbs in locomotion. This disorder is not, as was once supposed, a form of paralysis (there being no diminution of muscular strength), but is dependent on the loss of power of co-ordinating the muscles into harmonious action, which is essential to the proper performance of the voluntary movements of the body, and the maintenance of its equilibrium. Although the disease had been previously noticed both by Professor Romberg and Dr. R. B. Todd, it was first fully described and named by Dr. Duchenne in 1858. Its pathology has subsequently been investigated by Mr. Lockhart Clarke.

Locomotor ataxy usually begins insidiously, and advances slowly.

The pathological condition giving rise to locomotor ataxy is disease of a certain portion of the spiral cord, viz., the posterior columns and the posterior nerve roots. These undergo various transformations, which result in their ultimately becoming atrophied and indurated. When affecting, as this lesion most commonly does, the lower dorsal and lumbar regions of the cord, the ataxic symptoms are chiefly confined to the legs; but when it affects the cervical portion, the arms are involved. Occasionally the whole posterior columns of the cord are found diseased. The exciting causes of this malady are but ill understood. Exposure to cold and privation, intemperance, over exertion, and mental anxiety have been supposed to give rise to it.

ATBARA (Bahr-el-Aswad, or Black river), an important river of Eastern Africa. It rises in the mountains of Abyssinia, and unites with the Nile at El-Damer. During the rains it has an average depth of from thirty-five to forty feet.

ATCHAFALAYA (the Lost Water), a river of Louisiana, or secondary channel of the Mississippi, by which a portion of its water flows off from the main trunk into the Mexican Gulf. Its mouth is 120 miles west of the principal embouchure of the Mississippi.

ATCHISON, the county seat of Atchison county, Kan., is situated on the right bank of the Missouri river, equidistant from Leavenworth and St. Joseph. The railway facilities available are exceptionally complete and desirable, embracing the Atchison, Topeka and Santa Fé; Chicago, Rock Island and Pacific; Burlington and Missouri River; Kansas City, St. Joseph and Council Bluffs; Missouri Pacific; and Leavenworth Northern and Southern systems. The city also has communication with points on the Missouri and Mississippi rivers by steamers. Within the past ten years Atchison has grown rapidly in wealth and population, being to-day one of the most promising and enterprising cities of the West, and the railroad center of the State. It has thirteen churches, nine banks, three daily and three weekly papers, a court-house, high school, and five public school buildings, three colleges, a public library and an abbey conducted by the Society of St. Benedict, half-a-dozen large and well equipped hotels, an elegantly finished opera-house and a number of public halls, besides very many handsome private residences. A large iron railway and foot bridge spans the river opposite the city. The manufactures are numerous and varied, including carriages, furniture, hardware, oil, canned goods, lumber products, etc. The city is also the location of the machine and repair shops of the Burlington and Missouri River railroad. It is lighted by gas and electricity, enjoys street railway conveniences, and had a population (1900 census) of 15,722.

ATE, in *Greek Mythology*, a personification of criminal folly. She had misled even Zeus to take a hasty oath, when Heracles was born, for which, seeing his folly, he cast her by the hair out of Olympus, whither she did not again return. She fell, it was in later times said, on the hill where Troy was built.

ATELLA, an ancient city of Campania, about nine miles from Naples. In the second Punic war it sided with Hannibal, and, in consequence, its inhabitants were dispersed by the Romans, and their places supplied by the people of Nuceria. It is now after various fluctuations of fortune, a mere mass of ruins.

ATH, or **AETH**, a city of Belgium, in the province of Hainaut, situated on the river Dender, a navigable confluent of the Schelde, rather more than thirty miles by rail from Brussels. Population, 10,081.

ATHABASCA, or **ATHAPESKOW**, a river in the north-western territory of British North America, which flows into a lake of the same name. It rises in the Rocky Mountains, and has a long and tortuous course in a north-eastern direction, during which it receives the Lesser Slave River, the Red Deer, and several others. The lake is about 230 miles in length, with a breadth varying from 30 to 14 miles, lying in a direction almost E. and W. It communicates with Hudson's Bay on the one hand, and with the Polar Sea on the other.

ATHALIAH, the daughter of Ahab and wife of Jehoram, king of Judah, who, after the death of King Ahaziah, her son, caused all the male members of the royal house of Judah to be massacred, in order that she might usurp the throne. Among the victims were her own grandchildren, except the youngest, Joash, who was concealed in the temple by his aunt, Jehosheba, wife of the high priest, Jehoiada.

ATHANASIUS, Sr., Bishop of Alexandria, and one of the most illustrious defenders of the Christian faith, was born at Alexandria about the year 297. Of his family, circumstances, or early education nothing can be said to be known, although a legendary story has been preserved by Rufinus of Aquileia as to the manner in which he came, while yet a boy, under the notice of his predecessor, Alexander. It seems certain that Alexander became his patron, took him as a youth into his house, and employed him as his secretary. This was probably about 313, and from this time Athanasius may be said to have been devoted to the Christian ministry. He was, no doubt, a student in the "Didascaleon," or famous "catechetical school" of Alexandria, which included amongst its already illustrious teachers the names of Clement and Origen. In the museum, the ancient seat of the Alexandrian university, he may have learned grammar, logic, and rhetoric. His mind was certainly well disciplined, and accustomed to discuss from an early period the chief questions both in philosophy and religion. The persecution under which the Alexandrian Church suffered at this time, and his intimacy with the great hermit Antony, of which he himself has told us, had all their effect upon his character, and served to nurture in him that undaunted fortitude and high spirit of faith by which he became distinguished. At the Council of Nicea, in the year 325, he appears prominently in connection with the dispute. He attended the council, not as one of its members (who were properly only bishops or delegates of bishops), but merely as the attendant of Alexander. In this capacity, however, he was apparently allowed to take part in its discussions, for Theodoret (i. 26) states that "he contended earnestly for the apostolic doctrines, and was applauded by their champions, while he earned the hostility of their opponents. Within 'five months' after the return of Alexander to the scene of his episcopal labors he expired, and his friend and archdeacon was chosen to succeed him. He was elected 'in the sight and amidst the acclamations of the people.' He was now about 30 years of age, and is spoken of as remarkable both for his physical and mental characteristics."

The first few years of the episcopate of Athanasius were tranquil; but the storms in which the remainder of his life was passed soon began to gather around him. The Council of Nicea had settled the creed of Christendom, but had by no means composed the divisions in the church which the Arian controversy had provoked. Arius himself still lived, and his friend Eusebius of Nicomedia rapidly regained influence over the emperor Constantine. The result of this was a demand made by the emperor that Arius should be re-admitted to communion. Athanasius stood firm, and refused to have any com-

munion with the advocates of a "heresy that was fighting against Christ." Constantine was baffled for the moment; but many accusers soon rose up against one who was known to be under the frown of imperial displeasure. The archbishop of Alexandria was charged with cruelty, even with sorcery and murder. It was reported that a Meletian bishop in the Thebaid, of the name of Arsenius, had been unlawfully put to death by him. He was easily able to clear himself of such charges, but the hatred of his enemies was not relaxed, and in the summer of 335 he was peremptorily ordered to appear at Tyre, where a council had been summoned to sit in judgment upon his conduct. He did not venture to disobey the imperial order, and a commission was appointed to inquire into an alleged instance of cruelty urged against him, notwithstanding the explanations which he had made. There appeared plainly a predetermination to condemn him, and he fled from Tyre to Constantinople to appeal to the emperor himself. "He resolved," says Gibbon, "to make a bold and dangerous experiment, whether the throne was inaccessible to the voice of truth." He presented himself suddenly with five of his suffragans before the emperor, while riding into his new capital. Refused at first a hearing, his perseverance was at length rewarded by the emperor's consent to his reasonable request — that his accusers should be brought face to face with him in the imperial presence. The leaders of the Tyrian council, amongst the most conspicuous of whom were the two Eusebii, were accordingly summoned to Constantinople, just after they had celebrated, at a great dedication festival at Jerusalem, the condemnation of Athanasius and the restoration of Arius to church communion. In confronting the former before Constantine they did not attempt to repeat the charge of cruelty, but found a more ready and effective weapon to their hands in a new charge of a political kind — that Athanasius had threatened to stop the Alexandrian corn-ships bound for Constantinople. Here, as in other matters, it is very difficult to understand how far there was any truth in the persistent accusations made against the prince-bishop of Alexandria. Probably there was in the very greatness of his character and the extent of his popular influence a certain species of dominance which lent a color of truth to some of the things said against him. On the present occasion his accusers succeeded in at once arousing the imperial jealousy; and the consequence was, that, notwithstanding his earnest denial of the act attributed to him, he was banished to Trier, or Treves, the capital of Gaul.

This was the first banishment of Athanasius, which lasted about two years and a half. It was only brought to a close by the death of Constantine, and the accession of Constantine II. as emperor of the West. It is recorded by himself that, on his return to Alexandria, "the people ran in crowds to see his face; the churches were full of rejoicing; thanksgivings were offered up everywhere; the ministers and clergy thought the day the happiest in their lives." But this period of happiness was destined to be short-lived. His position as patriarch of Alexandria placed him, not under his friend Constantine II., but under Constantius, another son of the elder Constantine, who had succeeded to the throne of the East. He in his turn fell, as his father had done, more and more under the influence of Nicomedian Eusebius, now transferred to the see of Constantinople. A second expulsion of Athanasius was accordingly resolved upon. The old charges against him were revived, with the addition of his having set at naught the decision of a council. It was further resolved on this occasion to put another bishop in his place. Accordingly, in the beginning of the year 340, a Cappadocian

named Gregory, said to be an Arian, was installed by military force on the throne of the great defender of the faith, who, to save his followers from outrage, withdrew to a place of concealment. As soon as it was possible he repaired to Rome, to "lay his case before the church." He was declared innocent at a council held there in 342, and in another held at Sardica some years later. Julius, the bishop of Rome, warmly espoused his cause, and, generally, it may be said that the Western Church was Athanasian in its sympathies and its creed, while the majority of the Eastern bishops sided with the Eusebian party. This severance was clearly shown at the Council at Sardica, where the Orientals refused to meet with the representation of the Western Church, because the latter insisted on recognising the right of Athanasius and his friends to attend the council as regular bishops. The commonly received date of this council is 347, but the rediscovered *Festal Letters* of Athanasius have had the effect of throwing back this date for some years. It has been placed by some as early as the end of 343, by Mansi and others in the end of 344. The decision of the Council of Sardica, however, had no immediate effect in favor of Athanasius. Constantius continued for some time implacable, and the bold action of the Western bishops only incited the Arian party in Alexandria to fresh severities. Gradually, however, the excesses of the Arian party brought their own revenge, while the death of the intruded bishop Gregory, in the beginning of 345, opened up the way for a reconciliation betwixt the Eastern emperor and the banished prelate. The result was the restoration of Athanasius for the second time, amidst the enthusiastic demonstrations of the Alexandrian populace, which is represented by his panegyrist, Gregory Nazianzen, as streaming forth "like another Nile" to meet him in the distance as he approached the city. His restoration is supposed to have taken place, according to the more accurate chronology based upon the *Festal Letters*, in October 346.

For years at this time Athanasius held his ground in Alexandria. But the intrigues of the Arian or court party were soon renewed against him, and the feeble emperor, who had protested that he would never again listen to their accusations, was gradually stimulated to new hostilities. A large council was held at Milan in the spring of the year 355, and here, notwithstanding the vigorous opposition of a few faithful men amongst the Western bishops, a renewed condemnation of Athanasius was procured. This was followed up by the banishment of the faithful prelates, even of Hosius of Cordova, whose conciliatory character and intimate connection with the imperial family had not prevented him from addressing to Constantius a pathetic remonstrance against the tyranny of the Arian party. When his friends were thus scattered in exile, their great leader could not long escape; and on the night of the 8th of February 356, while he was engaged in service in the church of St. Thomas, a band of armed men burst into the sacred building. He has himself described the scene (*Apol. de fuga*, 24). Here for a time he maintained his composure, and desired the deacon to read the psalm, and the people to respond — "*For His mercy endureth for ever*;" and how, as the soldiers rushed forward with fierce shouts towards the altar, he at length made his escape in the crowd, and sought once more a place of safe retirement. The solitudes of Upper Egypt, where numerous monasteries and hermitages had been planted, appear to have been his chief shelter at this time. Here, protected from pursuit, he spent his time in literary labors in behalf of his cause; and to this period, accordingly, belong some of his most important writings, above all the great *Orations*,

Discourses against the Arians, which furnish the best exposition of his theological position and principles.

For six years at this time Athanasius continued in exile, till the death of Constantius in November 361 opened once more the way for his return to his episcopate. Julian, the successor to the imperial throne, professed indifference to the contentions of the church, and granted permission to the bishops exiled in the late reign to return home. Amongst others, Athanasius took advantage of this permission, and seated himself once more upon his throne, amidst the jubilations of the people. He had begun his episcopal labors with renewed ardor, and summoned a council to Alexandria to decide various important questions, when an imperial mandate yet again drove him from his place of power. The faithful gathered around him weeping. "Be of good heart," he said, "it is but a cloud: it will soon pass." His forecast proved true; for within a few months Julian had closed his brief career of Pagan revival, and Athanasius "returned by night" to Alexandria. He received a letter from the new emperor, Jovian, praising his Christian fidelity, and encouraging him to resume his work. With the emperor he continued to maintain friendly relations, and even drew out for him a synodal letter embodying the Nicene Creed, which was graciously received. During the brief reign of this bluff soldier-prince, comparative quiet prevailed in the church. But the repose was of short duration. In the spring of 365, after the accession of Valens, troubles reappeared. An order was issued for the expulsion of all bishops who had been expelled by Constantius, and Athanasius was once more forced to take refuge in concealment from his persecutors. His concealment, however, only lasted for four months, when an order came for his return; and from this time (Feb. 366) he was left undisturbed to pursue his episcopal labors. Those labors were unceasing in refuting heretics, in building churches, in rebuking rapacious governors, in comforting faithful bishops, and in strengthening the orthodox everywhere, till at length, in the spring of 373, "in a good old age," he ceased from all his work. Having consecrated one of his presbyters his successor, he died quietly in his own house. His "many struggles," according to his panegyrists, won him "many a crown." He was gathered to his fathers, patriarchs, prophets, apostles, and martyrs, who had contended for the truth. Even those who fail to sympathize with the cause which Athanasius steadfastly maintained, cannot refuse their tribute of admiration to his magnanimous and heroic character. The cynic eloquence of Gibbon grows warm in recounting his adventurous career, and the language of Hooker breaks into stately fervor in celebrating his faith and fortitude. "The whole world against Athanasius, and Athanasius against it; half a hundred of years spent in doubtful trial which of the two in the end should prevail — the side which had all, or else the part which had no friends but God and death — the one a defender of his innocence, the other a finisher of all his troubles." If imperious in temper and inflexible in dogmatic determination, Athanasius had yet a great heart and intellect, enthusiastic in their devotion to Christ, and in work for the good of the church and of mankind.

His chief distinction as a theologian was his zealous advocacy of the essential divinity of Christ as co-equal in substance with the Father. This was the doctrine of the Homoousain, proclaimed by the Nicene Creed, and elaborately defended by his life and writings. Whether or not Athanasius first suggested the use of this expression, he was its greatest defender; and the catholic doctrine of the Trinity has ever since been more identified with his "immortal" name than with any other in the history of the church and of Christian theology. (For

an exposition of the Athanasian Creed, see the article CREEDS.)

ATHEISM is the doctrine that there is no God. The word, which first appears in English literature in the latter part of the sixteenth century, is derived from Greek negative prefix *a*, and *Theos*, "God." The name atheist is said to have been first applied in Greek literature to one of the followers of the materialistic philosopher Democritus.

ÆTHELSTAN, or ÆTHELSTAN, son of King Edward the elder, and grandson of Alfred the Great, was born in 895. There has been much doubt with regard to his legitimacy, as his mother, Egwyn, is said to have been of humble origin; but these suspicions appear to rest on slight foundations. On the death of Edward in 925, Athelstan, who had been named by him as his successor, was elected king by the Mercians and West Saxons, and crowned at Kingston in Surrey. Anlaf, a Danish chief, or, according to some accounts, a son of Sihtric, with the king of Scotland, the Welsh, and the Danes of the north, invaded England. Athelstan, with his half brother Edmund, met and signally defeated the invaders in the battle of Brunanburh, celebrated in the "Brunanburh War-Song." In 940 or 941 Athelstan died at Gloucester.

ATHENA, in *Greek Mythology*, a goddess who, from being originally a personification of the clear, bright upper region of the sky, had, as early as the time of the epic poets, changed, or advanced, so as to embody under a divine form a conception of the clear insight of the human mind in its various functions. This upper air or ether seemed to be a distinct element in the universe. From it came the light of morning before sunrise and of evening after sunset, reminding us of the light which, in the Mosiac account of the Creation, existed before the sun and moon were placed in the sky. In the first stage of her character, in which, like the other deities of Olympus, she was directly identified with an element of nature and supposed to act as it acted, Athena bore the name of Pallas, and was thought of more in connection with the storms than with the serenity or light of the heavens. The obvious counterpart of a storm was a raging battle, and, accordingly, she became a goddess of war, armed with spear and helmet, and with the *ægis*, or storm-shield, of her father, resistless among men, hurling to the ground the giant Enceladus, and even superior in might to Ares himself, the god of war. The storm sweeps sores round high citadels, where also the storms of war rage fiercest; and on such places was her favorite abode. But a storm is followed by serenity brighter than before, more enjoyable, and more exciting to activity of every kind; and then the goddess lays aside her armor to encourage and foster skill and industry. Her title is then Ergane. To her was ascribed the invention of spinning and weaving; of taming horses, bridling and yoking them to the war-chariot; of the flute, and in some way of the healing art. This is the second stage of her character, which the myth, agreeably to its principle, explains in a different fashion, when it says that she sprang into existence from the brain of the all-wise ruler of the world, Zeus, and that he had before swallowed his wife, Metis (intelligence). She must therefore have been in a measure a complement of him, created for the purpose of carrying out among men what was in his mind, but what yet he could not himself, as the supreme and impartial ruler, execute. As his substitute, she lent her aid to Heracles in all his hardships and adventures; to Theseus under similar circumstances; to the Greeks in their war against Troy; to Perseus in slaying the Gorgon Medusa, whose head she afterwards bore upon her *ægis*, from which she obtained the name of Gorgophone; and to the Argonauts on their expedition to Colchis.

She maintained always her character as a virgin, and, to express this, bore, at Athens in particular, the name of Parthenos. Her birth took place in Olympus, in presence of the other deities, Hephaestus aiding it, as it is coarsely said, by splitting open with his hatchet the skull of Zeus, a subject often represented on the ancient painted vases. This was also the subject of the sculptures in the front pediment of her greatest temple, the Parthenon at Athens. From the fact that in the other pediment the sculptures represented her contest with Poseidon for divine supremacy over Attica, it might perhaps seem that the first act of her existence was to claim this sovereignty. Foremost in her character always is her protection of high citadels, like that of Athens. Yet it was not for this, but for her causing an olive to grow on the bare rock of the Acropolis, that she was chosen rather than Poseidon, whose claim was that he had raised on the same rock a spring of brackish water. The olives of Attica were a source of great wealth, and the light supplied by their oil may have seemed not unlike the light of the ether. As the defender of citadels her title was *Polias*.

ATHENÆUM, a name originally applied to buildings dedicated to Athena (*Minerva*), was specially used as the designation of a temple in Athens, where poets and men of learning were accustomed to meet and read their productions. The academy for the promotion of learning which the Emperor Hadrian built at Rome, near the Forum, was also called the *Athenæum*. Poets and orators still met and discussed there, but regular courses of instruction were given by a staff of professors in rhetoric, jurisprudence, grammar, and philosophy. This species of university continued in high repute till the 5th century. The same name was afterwards applied to similar institutions in Lyons and Marseilles; and it has become a very general designation for literary clubs or academies. It has also been used as the title of literary periodicals, particularly of the journal of art criticism edited by the brothers Schlegel, and the two well-known modern papers published in London and Paris.

ATHENÆUS, a Greek rhetorician and grammarian, or man of letters, was a native of Naucratis, a town in Egypt, near the mouth of the Nile. Exceedingly little is known of his life, but from one or two references to known events which occur in his works it may be gathered that he flourished about the end of the 2d and the beginning of the 3d century A.D.

ATHENAGORAS, a Christian apologist, was a native of Athens, and lived during the 2d century A.D.

ATHENODORUS, surnamed *CANANITES* or *SANDONUS*, a Stoic philosopher, was born at Tarsus. He probably gave instruction to Augustus when he was at Apollonia; and on proceeding to the Roman courts, he was made tutor to Tiberius. The emperor esteemed him greatly for his proved virtue and probity. He was in the habit of giving his opinion very freely, and warned Augustus, whenever he found himself giving way to anger, to rehearse the twenty-four letters of the alphabet before saying or doing anything. Retiring late in life to his native town, he died there at the age of 82.

ATHENRY, a decayed town in Ireland, county of Galway, and province of Connaught, 14 miles E. of Galway.

ATHENS (*Ἀθῆναι*, *ATHENÆ*) was the name of as many as nine towns in various parts of the Grecian world, among which *Athēna Diades*, in the N.W. of Eubœa, a town belonging to the Athenian confederation, is worthy of mention. But it was the capital of Attica which invested the name of Athens with an undying charm for the poet, the artist, the philosopher, the his-

torian, for all time. Towards the south of the central plain of Attica, about $4\frac{1}{2}$ miles from the harbor of Piræus, and nearly 4 from the Bay of Phalerum. The survey of Pausanias, when compared with existing remains, and supplemented by the numerous incidental notices of ancient authors, enables us to form a more perfect conception of the topography of ancient Athens than of any other Greek city. Recent excavations have added greatly to our knowledge of it, and the literature of the subject is very extensive.

There seems little reason to doubt that the earliest settlement on Athenian soil was upon the cliff afterwards famous as the Acropolis. The earliest inhabitants appear to have been Pelasgians; and though it was the boast of the Athenians that they alone of all Greek states were indigenous, yet their town would from the first have received accessions from various parts of the continent, the peaceful poverty of Attica affording a welcome refuge in those early and unsettled times. The most accessible portion of the Acropolis is the western side, where it is joined by a neck of hill to the Areopagus. On this side there existed down to later times the remains of fortifications built by the earliest inhabitants, with nine doorways, one within the other. This fort protected the only entrance to the citadel, which was surrounded by a wall, and artificially levelled for the reception of buildings. Within this fortified enclosure stood the shrine of Athena *Polias* afterwards known as the *Erechtheum*,—and an altar of Zeus *Polieus*, where the strange sacrifices of the *Dipolia* were celebrated. A *Prytaneum*, containing the hearth-fire of the state, and serving as the residence of the king, would be another indispensable feature in the primitive town.

To the west of the Acropolis there extends from N. to S. a range of hills, the three most prominent heights of which are commonly known respectively as the Hill of the Nymphs, the *Pnyx*, and the *Museum*,—the Nymphs' Hill being separated from the Acropolis by the Areopagus, which intervenes between. Everywhere upon the slopes of the hills just mentioned traces have lately been discovered of ancient dwellings hewn out of the solid rock. But while all these rock-dwellings are exceedingly ancient, yet some appear less primitive than others; it is remarked that those which exist on the Areopagus and on the hill-sides nearest to the Acropolis are of a smaller and ruder type, those more distant from the citadel being somewhat more convenient in plan and extent. Legend declares the Athenians to have originally dwelt in rock-hewn caves, and it would seem that primitive Athens gradually extended itself from the Acropolis in this W. and S.W. direction. This quarter was afterwards known as the intramural deme of *Melite*, a name derived, perhaps from the balm which then grew there. As the population of the early town continued to increase, two more districts seem to have been incorporated—*Collytus*, extending from the east of *Melite*, between the Acropolis and Areopagus, and *Caramœicus*, or the "Potters' quarter" ("*Tuileries*"), which extended from the same two hills towards the north and north-west. The regions we have now described appear to have made up the Athens of Solonian times. The earliest historical event which illustrates Athenian topography is the rising of Cylon. The narratives of that event imply that the Acropolis was already fortified by the *Enneapylum*, that the Areopagus was already the seat of the court which bore its name (see *AREOPAGUS*), and that near the entrance of the citadel stood an altar of the *Semnæ*, or *Furies*, at which Cylon and his partisans were slain. This altar has been immortalised by *Æschylus* in the splendid conclusion of the *Eumenides*.

The reign of the Pisistratidæ was recognised by the ancients as marking an important era in Athenian topography. It was Pisistratus who laid the foundation for the great temple of Zeus Olympius upon the ancient site above mentioned. His magnificent design had an eventful history: left unfinished by its author, the Athenians, perhaps from dislike to the "tyrant," made no effort to complete it. At length, after receiving additions from various foreign princes, it was completed by Hadrian (c. 130 A.D.), and formed the grandest edifice in the region of the city which, in acknowledgment of the imperial munificence, was called Hadrianopolis. The Olympium was one of the largest temples in the world; but of its 124 Corinthian columns only 15 are now standing. The *Pythium*, or sanctuary of the Pythian Apollo, near the Olympium, was also ascribed to Pisistratus, whose grandson and namesake dedicated an altar within it (Thucyd., vi. 54). To Pisistratus was ascribed the founding of the *Lyceum*, or temple of Apollo Lyceus, which stood on the right bank of the Ilissus, a short distance from the city. The names both of Pericles and Lycurgus the orator are also associated with this building; yet it is not known who added the gymnasium close by, which afterwards became famous as the favorite haunt of Aristotle, and the birthplace of the Peripatetic philosophy. The yet more famous seat of the rival philosophy seems also to have owed something to the Pisistratidæ, for Hipparchus was said to have enclosed the *Academy* with a wall.

The revolution which expelled the Pisistratidæ (510 B.C.), and gave Athens a free government, left its mark upon the topography of the city. The old Pelasgic fortress, in which "the tyrants" had for a time held out, was now broken down, and the site occupied by its ruins was devoted by the Delphic oracle to eternal desolation. Only in the Peloponnesian war, when the country population was crowded within the city walls, do we read of this spot being occupied by dwellings. Another work which may probably be assigned to the age of Clisthenes is the first arrangement of the Pnyx, or place of public assembly.

A building of greater architectural importance and of equal interest belongs to this same period. Dramatic performances at Athens originally took place in wooden theatres extemporised for the occasion; but the fall of one of these led, in the year 500 B.C., to the erection of the marble theatre on a site already consecrated to Dionysus as the Lenæum, upon the S.E. slope of the Acropolis. We may be sure that the first stone theatre was comparatively simple in construction, consisting of an auditorium, with tiers of rock-hewn seats, and an *ὄρχηστρον*, or space for the chorus, while the stage itself and its furniture were of wood. The excavation of the Dionysiac theatre in 1862 has made every one familiar with the row of marble thrones for the various priests and officers of state, the elaborate masonry of the stage, the orchestra floor, and other features. But these and other interesting decorations of the theatre belong to a later age. It was under the administration of Lycurgus the orator (337 B.C.) that the building was first really completed; and many of the sculptures which have been lately brought to light belong to a restoration of the theatre in the 2d, or perhaps even the 3d, century A.D.

Enough has now been said of the condition of Athens before the Persian War. It was surrounded by a ring-wall of narrow circuit, some doubtful traces of which are supposed to remain. At its centre stood the Acropolis, already crowded with temples and sanctuaries, some upon the summit, some built at its foot, and others—like the famous grotto of Pan, on the N.W. slope—mere caves in its rocky sides.

The Persian invasion, which forced the Athenians to

take refuge in their "wooden walls," and to leave their city at the mercy of the barbarians, marked an important epoch in the annals of Athenian building. Upon the retreat of Mardonius, the Athenians returned to Attica to find their city virtually in ruins. Its fortifications and public buildings had been destroyed or burnt, and the private dwellings had been wantonly defaced or ruined by neglect. Amid the enthusiasm of hope which followed upon the great deliverance of Greece, a natural impulse led the Athenians to rear their city more glorious from its ruins. Themistocles fanned their patriotism with the foresight of a statesman, and Athens rose again with marvellous rapidity. This haste, however, though creditable to their patriotism, and, indeed, necessary in order to forestall the jealous opposition of Sparta, was not without its evils. The houses were rebuilt on their old sites, and the lines of the old streets, narrow and irregular as they had been, were too readily followed. A similar haste marked the rebuilding of the city walls, a work in which men and women, old and young, took zealous part, not scrupling to dismantle any building or monument, private or public, which could supply materials for the building. But in rebuilding the walls Themistocles gave them a wider circuit, especially towards the N. and N.E. (Thucyd., i. 90, 93). At the same time he determined to construct new harbors, and to fortify the Piræus, regarding the navy of Athens as her principal source of strength. It is doubtful whether the "Long Walls" formed a distinct portion of his designs; but he may certainly be regarded as the founder of the greatness of Athens, the works and embellishments carried out by Pericles being only a fulfilment of the far-sighted aims of Themistocles. Thucydides makes the circuit of the city wall to be 43 stades (about 5½ miles), exclusive of the unguarded space between walls; this is found to correspond accurately enough with the existing remains. Having completed the defences of the city proper, among which must be included the building of the north wall of the Acropolis, Themistocles proceeded to fortify the Piræus.

Athens, like most of the old Greek towns, was built, for greater security, at a distance from the coast, and only when more settled times brought her greater prosperity was a harbor formed at the nearest bay of Phalerum, near the modern church of St. George. It is said that Themistocles would gladly have transported the Athenian population bodily from the upper city to the coast, there to form a great maritime state. Though this was impossible, yet he could strengthen Athens on the seaward side. The isthmus of Piræus, though somewhat more distant than Phalerum, presented obvious advantages as a seaport.

If not a part of the original designs of Themistocles, it was at least a natural development of them, to carry the "Long Walls" from the newly-fortified Piræus to the upper city, and thus combine them both into one grand system of fortification. The experiment of connecting a town by long walls with its port had been already tried between Megara and Nisæa, and it was now repeated on a grander scale under Cimon. It was Cimon who first set the example of providing the citizens with agreeable places for promenade (Plutarch, *Cimon*, xiii.), by planting the Agora with plane trees, and laying out the Academy with trees and walks. It is probable that some of the porticoes in the Agora were built by Cimon; at all events, the most beautiful one amongst them was reared by Pisanax, his brother-in-law, and the paintings with which Polygnotus, his sister's lover, adorned it (representing scenes from the military history of Athens, legendary and historical) made it ever famous. One more building, the most perfect existing relic of ancient

Athens, was also built by Cimon. The Theseium is a hexastyle Doric temple standing on an eminence due N. of the Areopagus, and is the first object which meets the eye of the tourist who approaches the city from the Piræus. Having served in Byzantine times for a Christian church, it is now a museum of antiquities, and contains some of the choicest treasures discovered by recent excavations.

We have now brought this sketch of Athenian topography down to the most distinguished period of Athenian history and Athenian architecture—the era of Pericles. As the champion of Hellenic freedom against the Persians, as the head of the Ionic confederation, Athens had suddenly grown to be the foremost city in Greece. But when one by one the confederate states sank into the position of subject-allies; when the supremacy of Athens passed insensibly into a tyranny; when the contribution of ships and men was commuted in most cases for a money payment, and the funds of the confederation were transferred from the Apollonium at Delos to the Athenian Acropolis,—an enormous revenue became at the disposal of the Athenian Government. It is to their credit that so little of it found its way into private pockets. It was natural for the thoughts of a Greek, especially of an Athenian, to turn to the decoration of his city; it was politic that the central city of the Ionian confederacy should be adorned with a beauty equal to her prestige. The buildings connected with the name of Cimon had been chiefly for utility or defence; those of Pericles were mainly ornamental. The first edifice completed by him seems to have been the Odeium, on the E. of the Dionysiæ theatre, to serve as a place for recitations by rhapsodists, and for musical performances. It was burnt by Aristion during Sulla's siege of Athens, but afterwards rebuilt. Mention has already been made of the building of the Long Walls and the laying out of the Piræus by Pericles; but it was the Acropolis itself which witnessed the greatest splendors of his administration. Within its limited area arose buildings and statues, on which the genius of Phidias the sculptor, of Ictinus and Mnesicles the architects, were employed for years; while multitudes of artists and craftsmen of all kinds were busied in carrying out their grand designs. The spoils of the Persian War had already been consecrated under Cimon to the honor of the national goddess, in the erection of a colossal statue of Athena by Phidias between the entrance of the Acropolis and the Erechtheum; her warlike attitude gained her the title of *Προμαχος*, and the gleam of her helmet's plume and uplifted spear was hailed by the homeward seaman as he doubled Cape Sunium (Pausan., i. 28). But the national deity was to receive yet greater honors at the hand of Pericles. He proceeded to rear what has since been known as the Parthenon. It was completed in the year 438 B.C. It stood upon the highest platform of the Acropolis, so that the pavement of the peristyle of the Parthenon was on a level with the capitals of the columns of the east portico of the Propylæa. The temple was built entirely of white marble from the quarries of Mount Pentelicus. Ascending a flight of three steps, you passed through the great east entrance into the Pronaos, wherein was stored a large collection of sacred objects, chiefly of silver. From the Pronaos a massive door led into the *cella*, called Hecatompedos, because it measured in length 100 Attic feet. The treasure here bestowed consisted chiefly of chaplets and other objects of gold. The west portion of the *cella* was raised off, and formed the *Parthenon* proper, i.e., the adytum occupied by the chryselephantine statue by Phidias of Athena Parthenos, —a work which yielded the pre-eminence only to one other statue by the same artist, viz., the Zeus at Olym-

pia. In this adytum were stored a number of silver bowls and other articles employed at the Panathenaic festivals. The westernmost compartment at the rear of the *cella* was the Opisthodomus, which served as the national treasury; hither poured in the tribute of the Athenian allies. It is important to remember that the Parthenon was never intended as a temple of worship; for this purpose there already existed another temple, presently to be described as the Erechtheum,—standing upon the primeval site of that contest between Athena and Poseidon which established the claim of the goddess to the Attic citadel and soil. The Parthenon was simply designed to be the central point of the Panathenaic festival, and the storehouse for the sacred treasure. The entire temple should be regarded as one vast *ἀνάθημα* to the national deity, not as a place for her worship. Thus directly in front of her statue in the *cella* there stood an erection, which has been mistaken for an altar, but which is more probably to be regarded as the platform which the victorious competitors in the Panathenaic contests ascended to receive, as it were from the hand of the goddess, the golden chaplets and vases of olive oil that formed the prizes. This consideration lends significance to the decorations of the building, which were the work of Phidias. Within the outer portico, along the outside of the top of the wall of the building, ran a frieze 3 feet 4 inches in height, and 520 feet in total length, on which were sculptured figures in low relief, representing the Panathenaic procession. Nearly all of these sculptures are in the British Museum, and the entire series has been recently made complete by casts from the other fragments, and arranged in the order of the original design. The marvellous beauty of these reliefs, which was heightened originally by color, has been long familiar to all the world from numerous illustrated descriptions. The processions of youths and maidens, of priests and magistrates, of oxen for sacrifice, of flute-players and singers, followed by the youthful chivalry of Athens on prancing steeds—is represented as wending its way from the west towards the eastern entrance. Outside of the building, on the N. and S. sides, the metopes between the Doric triglyphs were filled with sculptures representing scenes from the mythical history of Athens. But the glory of the Parthenon were the sculptures of the E. and W. pediments. Unhappily but a few figures remain, and none are wholly perfect, of the statues which formed these groups; and Pausanias appears to have thought it superfluous to give a minute description of objects so familiar to every connoisseur and traveller.

Opposite to the Parthenon, on the northern edge of the Acropolis, stands another remarkable temple, far smaller in size, and built in the most graceful forms of the Ionic order. The Erechtheum appears to be designed expressly to contrast with the severe sublimity of the Parthenon; and on the side which confronts those mighty Doric shafts, the columns of the smaller building are allowed to transform themselves into Canephori. The temple of Athena Polias, which contained the ancient wooden image of the Goddess, and formed the centre of her worship, suffered from fire in the Persian War (479 B.C.) A building so sacred would hardly have been allowed to remain for long in ruins; but it was reserved for Pericles to set about a complete restoration of it.

Among the many glories of the Acropolis, the Propylæa are described by Pausanias as being exceptionally magnificent (i. 22). They rivalled even the Parthenon, and were the most splendid of all the buildings of Pericles.

From the disastrous termination of the Peloponnesian war to the yet more fatal defeat at Chæroneia, the

architectural history of Athens is a blank, only interrupted by the restoration of the Long Walls and the rebuilding of the fortifications of Piræus by Conon, both of which had been destroyed by Lysander. The financial genius of the orator Lycurgus, whose administration lasted from 338 to 325 B.C., replenished to some extent the exhausted resources of his country.

The Macedonian period again marks a new epoch in the history of Athenian topography. Henceforward almost every embellishment Athens received was at the hands of the various foreign princes, whose tastes inclined them to patronise a city so rich in historical associations, and so ready to reward each new admirer with an equal tribute of servile adulation. But whatever decoration the city might owe to royal vanity or munificence, her connection with these foreign potentates brought her far more of injury than advantage. She became entangled in the wars, and usually found herself upon the losing side.

Upon the death of Alexander the Athenians claimed their liberty, but they at once had to submit to Antipater (322 B.C.), who placed a garrison in Munychia. It perhaps was he who defaced the ancient *Pyrex*; at all events, from this time forward the political oratory of Athens became silent for ever.

Under the rule of the Romans Athens enjoyed the privileges of a *libera civitas*, i.e., no garrison was introduced into the town, no tribute was levied upon it, and the constitution was left unaltered. The *Areopagus*, indeed, under Roman influence, recovered some of its ancient power, and was made to take precedence of the more democratic assemblies of the *Boule* and *Ecclesia*. The revision also of the laws by Hadrian would, of course, introduce some changes. Yet it may surely be maintained that Athens under the Roman dominion was in a far better position than in the days before the taking of Corinth by Mummius, when she had been at the mercy of each successive Macedonian pretender. The Romans appear to have shown a remarkable respect for the feelings of the Athenian people. It would be superfluous here to recall the warm expressions of admiration which fall from Cicero and Horace when speaking of Athens. A visit to Athens was regarded by the educated Roman as a kind of pilgrimage. One great disaster Athens did indeed undergo at the hands of Rome; this was the siege and plunder of the city by Sulla in the Mithridatic War.

It is uncertain at what exact date the *Horologium* of Andronicus of Cyrrhus was erected, which is generally known as the Tower of the Winds. It is first mentioned by Varro, and is therefore older than 35 B.C., though certainly not earlier than the Roman conquest. This monument, so familiar to every scholar, is described by Virruvius (i. 6, 4) as an octagonal tower of marble. It stands at what anciently formed the eastern extremity of the Roman Agora, presently to be described. On each face, beneath the cornice, is sculptured the figure of the wind which blew from the corresponding quarter; on the top of the roof was a pedestal supporting a bronze triton (now destroyed), which was constructed to turn with the wind, and to point out the wind's quarter with a wand which he held in his hand. The sculptured figures of the winds are in good preservation, though of a declining period of art. They represent the four cardinal points and the intermediate quarters between these. Each has his emblems: Boreas, the north wind, blows his noisy conch; Notus, the rainy south wind, bears his water-jar; Zephyrus, the west wind, has his lap full of flowers, and so on. Under each figure are the remains of a sun-dial; and besides all these external features, the interior was constructed to form a water-clock, supplied with water from the spring at the Acropolis called

Clepsydra. Thus in cloudy weather a substitute was provided for the dial and the sun.

The reign of Hadrian made literally a new era in the history of Athens. For Greece, and especially for Athens, this emperor entertained a passionate admiration. He condescended to hold the office of archon eponymus; in his honor a thirteenth tribe, *Hadrianis*, was instituted; and the emperor shared with Zeus the title of Olympius, and the honors of the newly-finished temple. While, however, many portions of the city bore witness to his munificence, it was in the southeastern quarter that most of his new buildings arose, in the neighborhood of the Olympium. This suburb was accordingly styled *Hadrianopolis*, or New Athens, to distinguish it from the old city of Theseus and of Themistocles. The arch of Hadrian still stands in a fairly perfect state, and marks the boundary between the ancient town and the new suburb embellished by Hadrian. At the same time many of the older buildings underwent restoration at his command. Nor was his bounty shown in works of building alone. He ceded to the Athenians the island of Cephallenia, and bestowed upon them large presents of money, and an annual largess of corn.

The immediate successors of Hadrian were guided by his example. Antonius Pius completed an aqueduct which Hadrian had commenced for bringing water into the town from Cephissus. Marcus Aurelius visited Athens for the purpose of initiation at the Eleusinian mysteries.

A few words may suffice to describe the ultimate fate of Athens. In the reign of Valerian the northern barbarians first appeared in the north of Greece, where they laid siege to Thessalonica. This extraordinary apparition having alarmed all Greece, the Athenians restored their city wall, which Sulla had dismantled, and otherwise placed the town in a state of defence sufficient to secure it against a *coup-de-main*. But under Gallienus, the next emperor, Athens was besieged, and the archonship abolished, upon which the strategos or general, who had previously acted as inspector of the Agora, became the chief magistrate. Under Claudius the city was taken, but recovered soon afterwards. Constantine the Great gloried in the title of General of Athens, which had been conferred upon him, and expressed high satisfaction on obtaining from the people the honor of a statue with an inscription,—a distinction which he acknowledged by sending to the city a yearly gratuity of grain. He also conferred on the governor of Attica and Athens the title of *Μέγας Δούξ*, or Grand Duke, which soon became hereditary; and his son Constans bestowed several islands on the city, in order to supply it with corn. In the time of Theodosius I., that is, towards the end of the 4th century, the Goths laid waste Thessaly and Epirus; but Theodorus, general of the Greeks, acted with so much prudence, that he saved the Greek cities from pillage and the inhabitants from captivity, a service which was most gratefully acknowledged. But this deliverance proved only temporary. The fatal period was now fast approaching, and, in a real barbarian, Athens was doomed to experience a conqueror yet more remorseless than Sulla. This was Alaric, king of the Goths, who, under the Emperors Arcadius and Honorius, overran both Italy and Greece, sacking, pillaging, and destroying. Never, indeed, did the fury even of barbarian conquest discharge itself in a fiercer or more desolating tempest. The Peloponnesian cities were overturned; Arcadia and Lacedæmon were both laid waste; the gulfs of Lepanto and Ægina were illuminated with the flames of Corinth; and the Athenian matrons were dragged in chains to satisfy the brutal desires of the barbarians. The inval-

able treasures of antiquity were removed; stately and magnificent structures were reduced to heaps of ruin; and Athens, stripped of the monuments of her ancient splendor, was compared by Synesius, a writer of that age, to a victim of which the body had been consumed, and the skin only remained.

From the period of the Ottoman conquest, 1455, to the commencement of the insurrection in 1821, Athens was only known in history by two attempts, on the part of the Venetians, to expel the Turks and make themselves masters of the city. The first of these took place in 1464, only nine years after its capture by the Osmanlis, and proved an entire failure. But the second, which was undertaken in 1687, more than two centuries later, was crowned with a temporary and fatal success. In the month of September of that year, Count Königsmark, a Swede in the service of Venice, having disembarked at the Piræus a force of 8000 foot and 870 horse, forming part of the armament under Francesco Morosini, afterwards doge, marched to Athens, and having summoned the citadel without effect, he erected a battery of heavy ordnance on the hill of the Pnyx, and placing two mortars near the Latin convent at the western foot of the Acropolis, bombarded it for several days. The fire of the cannon was chiefly directed against the Propylæa, and the modern defences below that edifice, whilst the mortars continued, without intermission, to throw shells into the citadel. The consequence was, that the beautiful little temple of Nike Apteros, the frieze of which is now at the British Museum, was completely destroyed by the breaching battery; and the Parthenon, besides being greatly injured by the bursting of the shells, was, towards the close of the attack, almost rent in pieces by the explosion of a powder magazine, which reduced the middle of the temple to a heap of ruins, threw down the whole of the wall at the eastern extremity, and precipitated to the ground every statue on the eastern pediment. The western extremity was fortunately less injured, and a part of the Opisthodomos was still left standing, together with some of the lateral columns of the peristyle adjoining to the cell. But the shock was nevertheless abundantly disastrous; and when the Turks afterwards regained possession of the citadel (from which, on this occasion, they were expelled), they did all in their power to complete the destruction which the Venetians had so vigorously begun, by defacing, mutilating, or burning for lime every fragment of the edifice within their reach.

In the course of the revolutionary war Athens sustained three sieges. The first was that by the Greeks in 1822. Having carried the town by storm, and driven the Turks into the citadel, they established a strict blockade of the fortress, which was continued until the advance of the Pasha with 4000 men induced them to abandon their enterprise, and fly, with the Athenians, to Salimis and Ægina. Two months afterwards, the Pasha having left Athens to the defence of 1500 men, the Greeks again ventured to attack the town, and succeeded in obliging the Turks to seek refuge in the citadel, which they forthwith determined to besiege; but, from ignorance and want of means, no progress whatever was made in the operation until they obtained possession of the well which supplied the garrison with water, when the Turks agreed to capitulate upon condition of being immediately embarked with their families and sent to Asia Minor.

With the liberation of Greece from the yoke of Turkey, begins the history of Modern Athens. Before the transfer of the capital from Nauplia by King Otho, who had been chosen to the throne of the new kingdom, Athens was a wretched village of a few hundred houses. Since

that time it has enjoyed a prosperous growth. Modern Athens has been built chiefly on the Eastern and Northern sides of the Acropolis, while the ancient city lay chiefly on the Southern and Western sides, and in its public buildings and newer parks; it reminds one of the better-built German cities. Its 1900 population is about 112,000, that of the Piræus being more than 43,000. It has a gymnasium on the German model, a school for the higher education of girls; several private schools of excellent character; a polytechnic school and a university, which numbers more than fifty professors in the various faculties, and about 1,400 students. A railway connects Athens with the Piræus; and street railroads run to outlying villages. Except in the back streets and remote corners, one would hardly think of Athens as at all an Oriental city. Its two chief business streets, "Hermes" and "Æolus," cross each other at right angles, and divide the city into four nearly equal parts. Of modern public buildings, the most noteworthy are the University, the Academy, which is built almost wholly of marble, and shows with beautiful effect the polychromatic decorations of the ancient Doric style, the Exposition Hall, and the Palace externally an ugly square building, but containing some spacious and handsome salons. Among the most recent erections are a magnificent building for the National Library and a fine theater. Both these structures, as well as the Academy and the Exposition Hall, are the gifts of wealthy Greeks, who reside mostly abroad, and take this way of showing their interest in the prosperity of their native country. Athens has become a center of archæological interest and study. Aside from the monuments mentioned above, it has many remains of antiquity stored and exhibited in its three museums. At the Eastern end of the Acropolis, the Archæological Society of Athens has erected a low building in which are preserved the remains and fragments of ancient art, which had been exhumed on the Acropolis. The most noteworthy of these are several slabs of the Parthenon frieze; a few reliefs of the beautiful balustrade of the Temple of Wingless Victory; fragments of the frieze of the Erechtheum, and the fourteen archaic statues of divinities or priestesses found in 1886 west of the Erechtheum. The museum contained in the Polytechnicum embraces the Mycencæ collection made by Doctor Schliemann; a large number of figurines from Tanagra, Myrina and other places, and a collection of vases, illustrative of every period in the history of vase painting.

ATHENS, the name of several towns in the United States of America, the chief of which are the following:—(1.) The capital of a county of the same name in the S. E. of the state of Ohio, finely situated on the Hocking river. It is the seat of the Ohio University, and contains 3,000 people. (2.) The capital of Clark county, Georgia, on the W. bank of the Oconee river. It is the seat of the Georgia university, which was founded in 1801, and the central town of a large cotton-growing district. Population (1900), 10,245.

ATHERTON or CHOWBENT, a township in the parish of Leigh and hundred of West Derby, in Lancashire 200 miles from London. It is one of those places which have grown to wealth and populousness through the extension of the cotton trade. Besides its factories, it has collieries and iron works. Population about 10,000.

ATHIAS, JOSEPH, a celebrated rabbi and printer at Amsterdam, whose editions of the Hebrew Bible are noted for the general correctness of the text.

ATHLETÆ, among the Greeks and Romans, was the designation of persons who contended for prizes in the public games, exclusive of musical and other contests, where bodily strength was not called into play, though

were also the word was sometimes applied, and it was even extended to horses which had won a race, and again metaphorically, *e.g.*, to persons who had exerted themselves in good deeds. On the other hand, the term was restricted so as to exclude those, who, for mere exercise, without the incentive of a prize, practised in the daily gymnastic competitions. Yet it was not the value of the prizes themselves which led men to devote their lives to athletic exercises. That was at most very insignificant. But from the heroic legends of competitions for prizes, such as those at the obsequies of Patroclus, from the great antiquity of the four national games of Greece (the Olympian, Pythian, Nemean, and Isthmian, with the local Panathenæa at Athens), and from the high social position of the competitors in early times, there gradually became attached to victory in one of these games so much glory that the townsmen of a victor were ready to, and frequently did, erect a statue to him, receive him in triumph, and care for him for the rest of his life. Against specially trained athletes the better class of citizens refused to compete, and the lists of the public games being thus left practically open only to professionals, training became more a matter of system and study, particularly in regard to diet, which was rigorously prescribed for the athletes by a public functionary, styled the *Aleiptes*, who also had to salve their bodies when practising. At one time their principal food consisted of fresh cheese, dried figs, and wheat bread. Afterward meat was introduced, generally beef or pork; but the bread and meat were taken separately, the former at breakfast, the latter at dinner. Except in wine, the quantity was unlimited, and the capacity of some of the heavy weights must have been, if such stories as those about Milo are true, enormous. Cases of death from apoplexy are not unknown among them. The Tarentine Iccus was an example of the strictest abstinence. Their instruction consisted, besides the ordinary gymnastic exercises of the palestra, in carrying heavy loads, lifting weights, bending iron rods, striking at a suspended leather sack filled with sand or flour, taming bulls, &c. Boxers had to practice delving the ground, to strengthen their upper limbs. The competitions open to the athletes were in running, leaping, throwing the discus, wrestling, boxing, and the Pancratium, or combination of boxing and wrestling. Victory in this last was the highest achievement of an athlete, and was reserved only for men of extraordinary strength. The competitors were naked, having their bodies salved with oil. Boxers wore the *caestus*, *i.e.*, straps of leather, round the wrists and forearms, with a piece of metal in the fist, which was sometimes employed with great barbarity. An athlete could begin his career as a boy in the contests set apart for boys. He could appear again as a youth against his equals, and though always unsuccessful, could go on competing till the age of 35, when he was debarré, it being assumed that after this period of life he could not improve. It sometimes happened that an athlete would agree to allow his rival to win; but for that and other cases of dishonesty a fine was imposed, and the money expended in erecting statues, with warning inscriptions. The most celebrated of the Greek athletes whose names have been handed down are Milo, Hippothenes, Polydamas, Promachus, and Glaucus. Cyrene, famous in the time of Pindar for its athletes, appears to have still maintained its reputation to at least the time of Alexander the Great; for in the British Museum are to be seen six prize vases carried off from the games at Athens by natives of that district. These vases found in the tombs, probably, of the winners, are made of clay, and painted on one side with a representation of the contest in which they were won, and on the other side with a

figure of Pallas Athena, with an inscription telling where they were gained, and in some cases adding the name of the eponymous magistrate of Athens, from which the exact year can be determined. Among the Romans, fond as they were of exhibitions of physical skill and strength, the profession of athletes was entirely an exotic, and was even under the empire with difficulty transplanted from Greece. The system and the athletes themselves were always purely Greek.

ATHLETIC SPORTS. Although this term is undoubtedly derived from the ancient, the derivation does not exactly indicate its present meaning, inasmuch as our modern athletes are distinctly defined to be amateurs, in contradistinction to professionals. In fact, the former pursue the agonistic art, and should be styled "agonistics," if we may be allowed to invent such a word, rather than athletes. How the pastime came to be thus named in Britain some thirty years ago it is hard to say. Till about 1860, all exercises wherein the feet played the principal part were rightly styled "pedestrianism." Up to that period all prizes, whether contended for by amateurs or professionals, were invariably in money. As the practice of the pastime, however, rapidly spread amongst the former, it was naturally found they were loth to compete on the same terms with, and for similar trophies as, the latter. Hence arose the modern definition of an amateur athlete, *viz.*, "Any person who has never competed in an open competition, or for public money, or for admission money, or with professionals for a prize, public money, or admission money; nor has ever at any period of his life, taught, or assisted in the pursuit of athletic exercises as a means of livelihood; nor is a mechanic, artisan, or laborer." The moment this definition was brought into force a wide barrier arose between the two classes, and amateurs ceased to compete for money prizes amongst themselves, or against professionals, on any terms, unless they were willing to forfeit their status.

ATHLONE, a market-town and parliamentary borough of Ireland, lying partly in West Meath and partly in Roscommon, 76 miles west of Dublin. The river Shannon divides the town into two portions, which are connected by a handsome bridge, opened in 1844. The rapids of the Shannon at this point are avoided by means of a canal about a mile long, which renders the navigation of the river practicable for 71 miles above the town. Population about 9,000.

ATHOL, a thriving town, situated in Worcester county, Mass., and the center of considerable commercial enterprise. Population (1900), 7,061.

ATHOR, ATHYR, HATHOR, the name of the Egyptian divinity corresponding to Aphrodite or Venus. Her name meant "the abode of Hor" or Horus, and she was the mother of that deity in some of his types, and as such a form of Isis, of whom she was a higher or celestial manifestation. Her name occurs as early as the 4th dynasty, when she is styled the mistress of the tree, or sycamore, *neha*, or the tree of the south. The solar deities Shu and Tefnut were her children. In certain legends she is mentioned as the seven cows of Athor, which appear in the Ritual or Book of the Dead. These cows, like the *Moira*, or fates of Greek mythology, appeared at the birth of legendary persons, and predicted the course and events of their lives. It is in this capacity that Athor is connected with Ptah, or the Egyptian Hephaestus, and is allied to Sekhet or Bast, called the wife or mistress of Ptah, the seven cows being the mystical companions of the Apis, the second life or incarnation of the god of Memphis. She was also represented under the attributes and with the titles of the goddess Nut, or the Egyptian Rhea. The cow of Athor wore on its head the solar disk, and hawk feathers

plumes; like Amen Ra; and in this character as the great cow she has on some monuments her human head replaced by that of a cow wearing a disk, or the disk and plumes. This emblem also appears in her type at a later period, when her head is represented with long tresses curled into a spiral at the end, and she has the ears of a cow instead of human ears. Her head is then surmounted by a doorway or its cornice, emblem of the abode of the sun, which she represented. This is sometimes surmounted by the disk and horns. The third month of the Egyptian year was named Athor after her, and the fish *aten* or *latus*, a kind of carp, was sacred to her.

ATHOS is, strictly speaking, the terminal peak of the most eastern of the three peninsular promontories which stretch south from the coast of Turkey (*Macedonia*), like the prongs of a trident, into the Archipelago. The name is, however, frequently extended to the whole peninsula which was formerly known as Acte. The peak rises like a pyramid, with a steep summit of white marble, to a height of 6,780 feet, and can be seen at sunset from the plain of Troy on the one hand, and on the other from the slopes of Olympus. The whole peninsula is remarkable for the beauty of its scenery, with rocky heights and richly-wooded flanks, ravines "embowered from the light," and glimpses of free outlook over the surrounding sea. The climate is for the most part healthy and pleasant, though the western side is perhaps too much exposed to the heats of summer; and Lucian assures us that in ancient times the inhabitants were famous for longevity. Several towns, such as Sane, Dium, Olophyxus, Cleonæ, are mentioned by Greek and Latin writers as existing in the Peninsula; but none of them seem to have attained any great importance, and the most remarkable event in the ancient history of Athos is the construction by Xerxes of a ship-canal across the isthmus between the outer sea and the Singitic gulf. Traces of this canal, which was regarded by Juvenal as a Greek myth, have been found almost right across the neck of land, and leave no doubt of the truth of the story. In more modern times the district of Athos has been famous for the number of hermits and monks that have found shelter in its retreats. No fewer than 935 churches, chapels, and oratories are said to exist, and many of the communities possess considerable wealth. It is believed that, with the exception of the dwellings of Pompeii, some buildings in Athos are the oldest specimens of domestic architecture in Europe; the shrines are in many cases richly decorated with goldsmith's work of great antiquity; the wealth of the monastic libraries in illuminated manuscripts has been long celebrated; and nowhere can the Byzantine school of painting be studied with equal advantage. The date of the oldest religious foundation in the peninsula is not clearly ascertained, and the traditional chronology of the monks themselves can hardly be trusted.

ATHY, a market-town of Ireland, county of Kildare, 34 miles S. W. of Dublin. It is a station on the Great Southern and Western Railway, and is intersected by the river Barrow, which is here crossed by a bridge of five arches. Population about 40,000.

ATINA, a town of Naples, province of Terra di Lavoro, near the Melfa and 12 miles S. E. of Sora. It has a cathedral, convent, and hospital, and about 5,000 inhabitants; but it is chiefly remarkable for its ancient remains, consisting of portions of its walls, the ruins of an extensive aqueduct, and numerous other structures, besides monuments and inscriptions. The city is of great antiquity, and was a place of importance down to the days of the Roman empire. It is remarkable now, as of old, for the exceptional coolness of its situation.

ATITLAN, a lake in the department of Solola, in

Guatemala, 20 miles long, with an average breadth of 9 miles. It seems to occupy the crater of an extinct volcano, and its depth is reported to be very great.

ATLANTA, the capital of Georgia, is situated about seven miles southeast of the Chattahoochee river, at an elevation of 1,100 feet above the sea. It was laid out in 1845, and became a city in 1847. It is the seat of extensive manufacturing interests, there being 390 factories, with an invested capital of \$16,500,000 and an annual product of \$16,722,000. Eight large trunk lines of railroad center here. Atlanta contains the State capitol (cost \$1,000,000), court-house, United States building, chamber of commerce, Confederate Home, many hospitals and asylums; sixteen schools, costing \$320,000 and seventy-three churches, valued at \$1,500,000. The city is lighted by gas and electricity, has twenty-five miles of main sewers, and new water-works taking an unlimited supply from the Chattahoochee river. There are fifty-five miles of electric, steam, dummy, and other street railroads; a fire department of fifty-five men, and a police force of 106 men. The city receipts in 1899 were \$1,968,518; the expenditures \$1,644,952. The assessed valuation is \$125,000,000, and the tax levy is limited to one-half per cent. During the war Atlanta was the scene of extensive military operations. (See UNITED STATES, JOHNSTON, JOS. E., and SHERMAN, WM. T.) The census of 1900 shows a population of 89,872.

ATLANTIC, capital of Cass county, Iowa, eighty-two miles west by south of Des Moines. It has two banks, printing offices, graded schools, and six churches, and a population (1900) of 5,046.

ATLANTIC CITY, a watering place on the eastern coast of New Jersey, in Atlantic county. Population (1900), 27,838, largely increased in the summer season.

ATLANTIC OCEAN. This designation, originally given to the sea that lies beyond the range of Atlas in North-western Africa, has come to be applied, with the extension of geographical knowledge, to the whole of that vast ocean which occupies the wide and deep trough that separates the New from the Old World. Its limits are variously defined; some geographers regarding it as extending from pole to pole, whilst others consider it as bounded at its northern and southern extremities by the Arctic and Antarctic circles respectively. As the peculiarity of the physical conditions of the Polar Seas renders it on every account more appropriate to describe them under a separate head (POLAR REGIONS), the Atlantic will be here treated as bounded at the north by the Arctic circle, which nearly corresponds with the natural closing-in of its basin by the approach of the coasts of Norway and Greenland with Iceland lying between them; while at the south, where the basin is at its widest, its only boundary is the Antarctic circle. The line which separates its southern extension from the Indian Ocean may be considered to be the meridian of Cape Agulhas, the southernmost point of the African continent; whilst the boundary between the South Atlantic and South Pacific would be formed in like manner by the meridian of Cape Horn. Although the Baltic and Mediterranean are commonly regarded as appendages to the Atlantic, yet their physical conditions are so peculiar as to require separate treatment.

Every physical geographer who has written upon the Atlantic has noticed the curious parallelism between its eastern and its western borders,—their salient and retiring angles corresponding very closely to each other. Thus, beginning at the north we see that the projection formed by the British Islands (which extends much further westwards at 100 fathoms below the surface than it does above the sea-level), answers to the wide entrance to Baffin's Bay; whilst, on the other hand, the projection of the American coast at Newfoundland answers to

the Bay of Biscay. Further south, the great rounded prominence of Northern Africa corresponds with the vast bay that stretches from Nova Scotia to St. Thomas; whilst the angular projection of South America towards the east corresponds with that receding portion of the mid-African coast-line which is known as the Gulf of Guinea.

This correspondence suggested to Humboldt the idea that the Atlantic basin was originally excavated by a very violent rush of water from the south, which, being repulsed by the mountain ranges of Brazil, was directed by them towards the coast of Africa, and formed the Gulf of Guinea; being there checked and turned to the west by the mountains of Upper Guinea, the stream excavated the Caribbean Sea and the Gulf of Mexico; and issuing thence, it ran between the mountains of North America and Western Europe, until it gradually diminished in velocity and force, and at length subsided. Another writer speaks of the basin of the Atlantic as an immense rift, made by some terrible force, which rent the surface-land asunder, but left the edges of the ravine to show by their form that they had once been connected. For neither of these speculations, however, is there the smallest foundation in fact. What has to be accounted for, indeed, in regard to either of the great areas at present covered by water, is not so much the excavation of its sea-bed, as its segregation from an ocean originally universal by the boundaries that now enclose it; in other words, not so much the depression of the bottom of its basin as the elevation of its sides. Not only is the proportion of the land-surface of the globe to its water surface scarcely more than one-third (being as 1 to 2.78), but the entire mass of the land which thus covers little more than one-fourth of the surface of the globe is quite insignificant in comparison with that of the water which covers the remaining three-fourths. For whilst the average elevation of the whole land is certainly less than one-fifth of a mile, giving from 9 to 10 millions of cubic miles as the total mass of land that rises above the sea-level, the average depth of the sea (so far as at present known) may be taken at about 2 miles, giving a total of nearly 290 millions of cubic miles of water, which is therefore about *thirty times* the mass of the land. From the computation of Keith Johnston, it appears that, "if we conceive an equalising line, which, passing around the globe, would leave a mass of the earth's crust above it, just sufficient to fill up the hollow which would be left below it, this line would then fall nearly a mile below the present level of the sea." This is tantamount to saying that, if the solid crust of the earth could be conceived to be smoothed down to one uniform level, its entire surface would be covered with water to the depth of about a mile. Hence it is obvious that as the elevation of that crust into land over certain areas must be accompanied by a corresponding depression of the sea-bed over other areas, such depression, augmenting in those areas the previous depth of the aqueous covering of the globe, would be quite sufficient to account for the existence of the great oceanic basins, without any excavating action. And a confirmation of this view is found in the fact, ascertained by recent surroundings, that the deepest local depressions of the sea-bed are met with in the neighborhood of islands that have been raised by volcanic agency. Further, as the quantity of solid matter that must have been removed (on Humboldt's hypothesis) in the excavation of the Atlantic valley must have been nearly four times as great as that which forms the whole known land of the globe, and as it is impossible to conceive of any mode in which such a mass can have been disposed of, we may dismiss that hypothesis as not only untenable in regard to the Atlantic basin, but as equally inapplicable to any other valley of similar width and depth.

The general direction of geological opinion, indeed, has of late been, on physical grounds, towards the high antiquity of the great oceanic basins, not exactly as at present bounded, but as areas of depression having the same relation as they have now to the areas of elevation which form the great continents. Thus Sir Charles Lyell was strongly impressed by the fact that the mean depth of the sea is not improbably fifteen times as great as the mean height of the land; and that the depressions of the sea-bottom to a depth of three miles or more extend over wide areas, whilst elevations of the land to similar height are confined to a few peaks and narrow ridges. Hence, he remarked, "while the effect of vertical movements equalling 1000 feet in both directions, upward and downward, is to cause a vast transposition of land and sea in those areas which are now continental, and adjoining to which there is much sea not exceeding 1000 feet in depth, movements of equal amount would have no tendency to produce a sensible alteration in the Atlantic or Pacific Oceans or to cause the oceanic and continental areas to change places. Depressions of 1000 feet would submerge large areas of the existing land; but fifteen times as much movement would be required to convert such land into an ocean of average depth, or to cause an ocean three miles deep to replace any one of the existing continents." And Professor Dana, who, more than any other geologist, has studied the structure of the existing continents and the succession of changes concerned in their elevation, has been led, by the consideration of the probable direction of the forces by which that elevation was effected, to conclude that the defining of the present continental and oceanic areas began with the commencement of the solidification of the earth's crust. "The continental areas are the areas of the least contraction, and the oceanic basins those of the greatest, the former having earliest had a solid crust. After the continental part was thus stiffened, and rendered comparatively unyielding, the oceanic part went on cooling, solidifying, and contracting throughout; consequently, it became depressed, with the sides of the depression somewhat abrupt. The formation of the oceanic basins and continental areas was thus due to 'unequal radial contraction.'" In the opinion of Professor Dana, there has never been any essential change in the relations of these great features. "It is hardly possible," he says, "to conceive of any conditions of the contracting forces that should have allowed of the continents and oceans in after time changing places, or of oceans, as deep nearly as existing oceans, being made where are now the continental areas; although it is a necessary incident to the system of things that the continental plateaus should have varied greatly in their outline and outer limits, and perhaps thousands of feet in the depths of some portions of the overlying seas, and also that the oceans should have varied in the extent of their lands." . . . "The early defining, even in Archæan times, of the final features of North America, and the conformity to one system visibly marked out in every event through the whole history—in the positions of its outlines and the formations of its rocks, in the character of its oscillations, and the course of the mountains from time to time raised—sustain the statement that the American continent is a regular growth. The same facts also make it evident that the oceanic areas between which the continent lies have been chief among the regions of the earth's crust that have used the pent-up force in the contracting sphere to carry forward the continental developments. If this was true of the North American continent, the same in principal was law for all continents."

Dimensions of the Atlantic.—The length of the At-

lantic basin, considered as extending from the Arctic to the antarctic circle, is nearly 8000 geographical miles. The nearest approach of its boundaries is between Greenland and Norway, whose coasts are only about 800 miles apart. They thence recede from each other towards the south, as far as the parallel of 30° N. lat., where, between the peninsula of Florida and the western coast of Morocco, there is an interval of 70° of longitude, or about 3600 geographical miles. The channel then rapidly narrows as it passes southward, so that between Cape St. Roque in Brazil (5° S. lat.) and the coast of Sierra Leone (between 5° and 8° N. lat.) the African and American continents approach within 1500 miles of each other. The sudden eastward recession of the African coast as it approaches the equator, and the westward trend of the South American coastline between Cape St. Roque and Cape Horn, widen out the South Atlantic basin to the same breadth as that of the North Atlantic in the parallel of 30° N., — the interval between the Cape of Good Hope and the estuary of La Plata, in the parallel of 35° S., being no less than $73\frac{1}{2}^{\circ}$ of longitude, or about 3600 geographical miles.

The depth of the North Atlantic has been more carefully and systematically examined than that of any other oceanic basin; and the general contours of its undulating sea-bed may now be regarded as pretty well determined. The greatest depth determined by the recent "Challenger" soundings, which was that of a limited depression about a hundred miles to the north of St. Thomas, is 3875 fathoms, or about 4.4 miles. Except in the neighborhood of its coast-lines, and in certain shallower areas to be presently specified, the floor of the basin at its widest part seems to lie at a depth of from 2000 to 3000 fathoms, its slopes being extremely gradual. The central portion of the principal basin of the North Atlantic, however, is occupied by a plateau of irregular shape, of which a considerable part lies at a less depth than 2000 fathoms. Of this plateau the Azores may be regarded as the culmination; and that group being taken as its centre, it may be said to extend to the north as far as lat. 50° , and to the south-west as far as the tropic of Cancer. The northern extension of this plateau narrows out into a sort of isthmus, which connects it with the plateau that occupies a great part of the Atlantic basin to the north of 50° N. lat.; and it is across this isthmus, and along the bottom of the deep narrow valley on either side of it, that the telegraph cables are laid between Ireland and Newfoundland.

Generally speaking, the depths of these valleys increase pretty rapidly with the distance from the shore-line, so that the contour-lines of one and two miles follow the shore-lines pretty closely. But there are two localities in which shallow water extends to a much greater distance from land than it appears to do elsewhere. One of these lies in the neighborhood of the British Isles. For a distance of about 230 miles to the westward of Ireland there is a slope of only about 6 feet in a mile; but in the next 20 miles there is a fall of 9000 feet, after which there is little change of level for 1200 miles. Hence as the depth of the sea immediately surrounding the British Isles is nowhere 100 fathoms (so that an elevation of their whole area to that amount would unite these islands not only to each other but also to the continent of Europe), it is obvious that the platform on which they rest is really, although now submerged, a part of the land-mass of Europe. Another of these extensive shallows is that of which the Banks of Newfoundland form the highest part; and of the existence of this a probable explanation may be found in the accumulation of the rock-masses that are brought down by icebergs every summer from the coasts of Greenland and Labrador. For it is now generally admitted that these

icebergs are really parts of glaciers, that were originally formed on the mountain-slopes of Greenland and Labrador, and then descended valleys which open out on their coasts, so as, on arriving at the mouths of these valleys, to detach themselves and float away, being borne southwards by the Polar Current to be presently described. Most Arctic icebergs of which a near view can be obtained are observed to have upon them a considerable number of pieces of rock, sometimes of a very considerable size; and these are of course deposited on the sea-bed when the icebergs melt (which they usually do on the borders of the Gulf Stream), thus forming a vast conglomerate bed, to which parallels are not improbably to be found in various geological epochs.

Geological Age of the Atlantic Basin. — Guided by the principle that great oceanic basins are to be considered rather as original marine areas that have been limited by the elevation of their boundaries, than as having been formed by the excavation of terrestrial areas, we have to inquire what evidence there is that the basin of the Atlantic has undergone any considerable change within a comparatively recent period.

As has been pointed out by Prof. Wyville Thomson, it is difficult to show that any oscillations have occurred in the north of Europe since the termination of the Secondary period, to a greater extent than from 4000 to 5000 feet, — this being the extreme vertical depth between the base of the Tertiaries and the highest point at which Tertiary or post-Tertiary shells are found on the slopes and ridges of mountains. Such oscillations, while considerably modifying the boundaries of the Atlantic, would not seriously affect the condition of the deeper parts of its sea-bed; and hence it may be concluded that the two deep valleys, one on the European side of the modern volcanic platform of the Azores, and the other on the American, each having a width of 600 or 700 miles, and an average depth of 15,000 feet, could neither have been formed by such oscillations, nor could, when once formed, have been converted into dry land. It will be presently shown that this idea of the existence of an Atlantic basin corresponding generally to that now existing, as far back as the later Secondary period, is strongly supported by the evidence recently obtained of the continuity of animal life on the Atlantic sea-bed from the Cretaceous epoch to the present time.

Important information as to the changes which the sea-bed of the Atlantic has undergone within the later geological periods, may be gathered from the structure of the islands which lift themselves above its surface. Along its eastern border, at no considerable distance from the coast of North Africa, there are three principal groups, — the Madeiras, Canaries, and Cape Verd, — all of which have an evidently volcanic origin, and rise up from the eastern slope of the basin, where it is progressively shallowing towards its continental shore-line. Further out, in mid-ocean, lies the group of the Azores, which also is volcanic, and rises from the plateau already spoken of; but between this area and the slope from which the Madeiras and Canaries are based is a very deep channel, ranging downwards to at least 15,000 feet; and a like depth is also found between the Azores and the coast of Portugal. The structure of all these groups of islands gives obvious indications of their formation by separate igneous eruptions in a sea of great depth; and the earliest of these eruptions seems to have taken place in the later Miocene period. As soon as the first solid lavas raised their heads above water, and were thus exposed to the action of the waves, fragments were detached and rounded on the shore; and these being swept off, with the *débris* resulting from their attrition, formed deposits of various kinds upon the slope of the cone, in which corals, shells, &c., were imbedded. These

fossiliferous deposits have been subsequently elevated to heights from 1500 to 2000 feet above the level of the sea, showing a rise of the base of the craters; progressive additions have been made to their upper part by the piling up of basaltic and trachytic lavas. That this state of activity still continues is proved by the fact that in 1811 a new island was temporarily formed in the Azores group, off St. Michael, by the throwing-up of ashes, and the formation of a cone about 300 feet high, with a crater in the center. This island, to which the name Sabrina was given, was soon washed away by the waves. And only a few years since, another submarine eruption in this neighborhood was indicated by earthquakes, jets of steam and columns of smoke, and floating masses of scoriæ. All these considerations concur (as Sir Charles Lyell, *loc. cit.*, justly urges) to negative on geological grounds the hypothesis which has been advocated by some eminent naturalists, that the Azores, Madeiras, and Canaries are the last remaining fragments of a continuous area of land which once connected them with the west of Europe and North Africa.

Proceeding to the south of the equator, we meet with similar evidence of volcanic activity in the structure of the only two islands, Ascension and St. Helena, which lie near the line stretching from the Cape Verd group to the Cape of Good Hope; and these also arise from a plateau of considerably less depth than the circumjacent area whose eastern slope gradually shallows to the coast of South Africa. This plateau stretches in a north-westerly direction towards the equator, so as to meet it from 20° to 22° W. long.; and here indications of volcanic activity—earthquakes, troubled water, floating scoriæ, and columns of smoke—have been several times observed since the middle of the last century, betokening the probable formation of an island or an archipelago in that locality.

Nearly midway between the southern prolongations of the African and American continents, the solitary peak of Tristan da Cunha lifts itself above the ocean; this also is volcanic, and seems to rise from a broad base of general elevation, resembling the plateau of the North Atlantic.

The entire chain of the Greater and Lesser Antilles, which stretches from the delta of the Orinoco to the peninsula of Florida, and forms the eastern boundary of the Caribbean Sea, seems to have been in like manner elevated by volcanic action. That this elevation, like that of the groups of islands on the eastern side of the Atlantic, took place for the most part during the later Tertiary period, is shown by the occurrence of shells, corals, &c., of upper Miocene age, in the upraised sedimentary beds of several of the islands; while the presence of "fringing reefs" of coral around the shores of many of the West India islands is an indication that they lie in a area in which elevation is still proceeding. The channels by which they are separated are so deep as to render it very unlikely that there was ever a continuity of land between them; and the occasional recurrence of earthquakes and volcanic eruptions at different points of this "line of fire," shows that the plutonic action by which the islands were raised is still going on beneath.

The case is very different, however, in regard to the Bermuda group, which constitutes a singular exception to the general fact of the absence in the Atlantic of those coral islands that are so numerous in the Pacific. This group consists of about 300 islands, of which, however, only five are of any considerable size; and these rise from a shoal or platform of about 23 miles long by 13 miles broad, the channels between the islands being very shallow, while at a small distance from the edge of the shoal, the bottom rapidly deepens

to 15,000 feet. The islands are entirely composed of upraised beds of coral, shells, &c. (the highest elevation being only about 180 feet above the sea-level); and the shoal itself appears to have the like structure throughout, no traces of any other rock than a limestone formed by the metamorphoses of coral being anywhere met with. Hence, as this insular platform proves to be the summit of a submarine column of 15,000 feet high, rising from a very small base, and as nothing we know of the structure of mountains—volcanic or other—would justify us in supposing that a column of such a height could be formed in any other way than by coral growth, the structure of the Bermuda group would seem to indicate a progressive subsidence of the bed of this part of the Atlantic during its formation, corresponding to that which (according to the well-known views of Mr. Darwin) is at present in progress over a large area of the Pacific. It is probable that this coral growth was determined in the first instance by the existence of a submarine mountain, of which the summit lay near the surface, or lifted itself above it; that as soon as this came to be submerged, the coral formation commenced; and that by its continued growth at the summit, at a rate equal to that of the subsidence of its base, the platform has been kept up to the sea-level. The slight elevation which has raised its highest portion above that level may not improbably have taken place in connection with the much larger recent elevations already referred to.

Thus, then, we have evidence of considerable recent local modifications in the level of the Atlantic sea-bed, without any such change as would affect its general character as an ocean basin; while all geological probability seems in favor of the remoteness of the principal depression of the Atlantic area, even if we do not regard it as dating back to the period when the surface of the globe was first undergoing solidification.

Currents of the Atlantic.—By the term "current" will be here meant that *sensible* movement of ocean water in particular directions which can be generally traced, directly or indirectly, to the action of wind upon its surface. A current thus directly impelled by wind is termed a "drift-current," whilst a current whose onward movement is sustained by the *vis a tergo* of a drift-current is called a "stream-current." But there is another source of current-movement, which has been overlooked by most writers on this subject, namely, the indraught which necessarily takes place to keep up the level of any area from which the surface-water is constantly being drifted away. Such currents, which may be designated as "indraught" or "supply currents" complete the "horizontal circulation" that must necessarily take place in any oceanic area of which one part is subjected to the action of a wind almost constantly blowing in the same direction. Of such a circulation we have a very characteristic example in the South Atlantic, the principal currents of which we shall see to be very easily accounted for.

The initial movement of the current-system, alike of the North and of the South Atlantic, is given by the trade-winds, which are continually driving the water of the inter-tropical region from the African towards the American side of the basin, so as to produce what is known as the *Equatorial Current*. The position of the northern and southern boundaries of this current shifts, like the area of the trade winds, in accordance with the northward and southward declination of the sun;—a steady westward drift being generally met with to the north of the tropic of Cancer in the summer of the northern hemisphere, and to the south of the tropic of Capricorn in the summer of the southern, whilst in the winter of each hemisphere the border of the drift

lies within the tropic of that hemisphere. But as the thermal equator lies from two to three degrees to the north of the geographical equator, the entire zone of the trade-winds, and of the Equatorial Current propelled by them, is wider on the northern than on the southern side of the latter; and while the northerly trade often reaches 30° N. in July, and rarely extends south in January within 2° or 3° of the geographical equator, the southerly trade does not extend farther than 25° S. in January, and generally crosses the equator in July, even extending occasionally as far as 5° N. As between the northerly and southerly trades there is a region of "equatorial calms," so there is a corresponding interval between the northern and southern divisions of the Equatorial Current; and in this interval there is a counter-current (resembling the "back-water" often to be noticed in a stream that is flowing rapidly past some obstacle, such as a vessel at anchor, or a projecting river-bank), that runs eastwards, sometimes with considerable velocity, towards the Bight of Biafra, which may be considered the "head-water" of the Equatorial Current. From the recent observations of Capt. Nares in the "Challenger," it appears that the Equatorial Current, like other drift-currents, is very shallow, its depth being not much greater than 50 fathoms. He estimates its rate at the surface to be about 0.75 miles per hour, or 18 miles per day, whilst at 50 fathoms it only moves at about half that rate. Its surface temperature generally ranges between 75° and 80° ; but the thermometer falls to 60° at a depth of little more than 100 fathoms,—the temperature of this belt of water, as will be hereafter shown, being kept down by the continual rising of polar water from below.

The Equatorial Current passes directly across the Atlantic towards the chain of the Antilles and the coast of South America; and as not only the whole of the northern division, but a considerable part of the southern, strikes the American coast-line to the north of the salient angle of Cape St. Roque (about 5° S. lat.), the portion of the current which is deflected into the northern hemisphere is much greater than that which is turned to the southward. It is a general fact, that where a current encounters any partial obstruction,—such as a coast-line meeting obliquely, a narrowing of its channel, the lateral pressure of another current, or even that of a mass of stationary water,—its velocity increases; and so the portion of the Equatorial Current that is pressed to the northward by the coast-line between Cape St. Roque and the mouth of the Orinoco (known in the first part of its course as the *Cape St. Roque Current*, and afterwards as the *Guiana Current*) acquires a greatly augmented rate, running ordinarily at the rate of from 30 to 50 miles, and occasionally at a rate of 80 miles, in the 24 hours. Entering the Caribbean Sea, it is reinforced by the portion of the Equatorial Current which flows in between the Lesser Antilles; and it then passes westwards along the northern coast of South America, until it is deflected northwards by the coast-line of Central America, and driven between the peninsula of Yucatan and the western extremity of Cuba into the Gulf of Mexico, at the rate of from 30 to 60 miles per day. A portion of it passes direct to the N.W. along the northern shore of Cuba; but by far the larger part sweeps round the gulf, following the course of its coast-line, and approaches the coast of Cuba from the N.W. as a broad deep stream of no great velocity, seldom running at more than 30 miles per day. The reunited current, being met by the Equatorial Current from the outside, which is pressing to the west along the north coast of Cuba and between the Bahama isles, is deflected northwards through the passage termed the Florida Channel, which is bounded on the one side by

the southern extremity of the peninsula of Florida, and on the other by the coast of Cuba and the Bahamas. The rate of movement of the powerful current that flows through this channel, henceforth known as the *Gulf Stream*, is considerably augmented in its narrowest part, which is also its shallowest; but although its velocity sometimes reaches 4 (nautical) miles per hour, or even more, its *average* rate through the whole year may be confidently stated at not more than 2 miles per hour, or 48 miles per day.

The Gulf Stream current, however, does not by any means occupy the whole of the sectional area of the Florida Channel; for it is separated from the American coast by a band of cold water, which occupies about three-eighths of its total breadth of 40 miles, and which also dips under the outflowing current. The movement of the cold superficial band is perceptibly inwards, and that of the cold under-stratum is presumably so; and it is the opinion of the American surveyors that the depth of the warm outward current is not more than one-third of that of the channel through which it flows. It is probable that the rate of movement decreases from the surface downwards; but upon this point we have as yet no certain information. The meaning of the cold inflow will hereafter become apparent.

The course taken by the Gulf Stream in the first instance is nearly parallel to the line of the United States coast, from which it is everywhere separated by a band of cold water,—the boundary line between the two being so distinct as to be known as the "cold wall." It does not show for some time any great disposition to spread itself out laterally, though a division into alternate bands of warmer and colder water, the cause of which seems to lie in the contour of the bottom of the Florida Channel, becomes perceptible before it reaches Charleston, and is very marked off Cape Hatteras. The Stream there presents the form of a fan, its three warm bands spreading out over the Atlantic surface to an aggregate breadth of 167 miles, whilst two cold bands of an aggregate breadth of 52 miles are interposed between them. The innermost warm band is the one which exhibits the highest temperature and greatest rate of flow, its velocity being greatest where it is pressed on laterally by the Arctic Current, so that a rate of 4 miles per hour is occasionally observed. Capt. Nares estimates the depth of the Stream in this part of its course at about 100 fathoms, and its rate of flow in the line of most rapid movement at 3 miles per hour. The outermost band, on the other hand, graduates insensibly, both as to temperature and rate of movement, into the general surface-water of the Atlantic. It is when passing Sandy Hook that the Gulf Stream takes its decided turn eastwards,—this change in its direction being partly due to the eastward bend of the United States coast-line, and partly to the *excess of easterly momentum* which it brings from the lower latitude in which it issued from the Florida Channel. Its general rate of flow past Nantucket seems not to exceed 1 mile per hour, and to be frequently less; but several degrees to the eastward of this, the current has been found occasionally running at the rate of 4 miles an hour,—this acceleration being probably due to the lateral pressure of the *Arctic Current*, which, during the early months of the year, is driven southwards at the rate of 10 or 12 miles per day by the N. and N.W. winds then prevailing along the coast of Labrador, and which, turning westwards round the south of Newfoundland, keeps close to the coast of the United States (being left behind in the rotation of the earth, in consequence of its *deficiency* of easterly momentum), and follows it southwards, everywhere separating it from the Gulf Stream. By the gradual thinning-out and expansion of the

Gulf Stream after passing the Banks of Newfoundland, by the progressive reduction of its rate of movement, and by the loss of that excess of temperature which previously distinguished it, as well as of its peculiar blue color (which probably depends on its holding in suspension the finest particles of the river-silt brought down by the Mississippi), this remarkable current so far loses all its special attributes, as to be no longer recognisable to the east of the meridian of 30° W. long.,—there degenerating into the general easterly drift of that region of the Atlantic which is kept up by the prevalence of westerly winds, sometimes called “anti-trades.” When the Florida Current or true Gulf Stream can last be distinctly recognised, it forms a stratum not more than 50 fathoms in thickness; and it is there flowing *almost due east*, at a rate which would require about 100 days to bring it to the Land’s End. The only valid evidence of the extension of any part of it to the western shores of Europe (the amelioration of their temperature being otherwise accounted for, while the transport of trunks of trees, drift-timber, fruits, shells, &c., to the Western Hebrides, the Orkney, Shetland, and Faroe islands, and the coast of Norway, may be fairly set down to the surface-drift sustained by the prevalence of S.W. winds) is afforded by the variable current known as *Rennell’s*, which, flowing eastwards into the southern part of the Bay of Biscay, is deflected in a N.W. direction by the trend of its coast-line, so as to cross the British Channel towards the Sicilly Islands, whence it passes to the S.W. coast of Ireland, its strength mainly depending on the continued prevalence of the westerly anti-trades.

Of the whole mass of water, on the other hand, that is brought into the mid-Atlantic by the Gulf Stream, it may be stated with confidence that the larger proportion turns southward to the east of the Azores, and helps to form the *North African Current*; the other tributary of which may be considered as originating as far north as Cape Finisterre, under the influence of the northerly winds which prevail along the coast of Portugal. As this current flows past the entrance to the Strait of Gibraltar, a part of it, forming what is known as the *Gibraltar Current*, is drawn in to keep up the level of the Mediterranean, which would otherwise be reduced by the excess of evaporation from its surface; but the greater part keeps its course southwards along the Morocco coast, reinforcing the south-flowing extension of the Gulf Stream. On arriving at the border of the northerly trade, the North African Current divides into two parts,—the western division being at once carried into the course of the equatorial drift, whilst the eastern, which may be considered as essentially an indraught or supply current follows the African coast-line, and turns eastward into the Gulf of Guinea, forming the *Guinea Current*, which, coalescing with the eastward “back-water” already mentioned, flows pretty constantly, sometimes with considerable rapidity, towards the Bight of Biafra. There it meets the *South African Current*, which forms the other great feeder of the Equatorial Current; and the circulation thus completed may be considered as recommencing from the “head-water.” The large area of comparatively still water which lies in the interior of this North Atlantic circulation is called the *Sargasso Sea*,—a corruption of the name (Mar de Sargáço) which it received from Columbus and the early Spanish navigators, on account of the quantity of sea-weed that floats on its surface. The boundaries of this area, which is of an irregularly elliptical shape, and nearly equals that of Continental Europe, are somewhat variable; but it may be considered to lie between the parallels of 20° and 35° N., and between the meridians of 30° and 60° W. Into it is

collected a large proportion of the drift or wreck which floats about the North Atlantic.

Proceeding now to the South Atlantic, we meet with a circulation of the same kind, uncomplicated by any embaying of the Equatorial Current. The smaller division of this current which strikes the coast of South America to the south of Cape St. Roque flows along the coast of Brazil at the rate of from 12 to 20 miles a day, forming the *Brazil Current*, which, however, is separated from the land by an intervening band of lower temperature, that has, during the winter months, a distinct flow towards the equator. The Brazil Current can be traced southwards, by its temperature rather than by its movement, as far as the estuary of the La Plata, before reaching which, however, a great part of it takes an easterly direction, and crosses the Atlantic towards the Cape of Good Hope, forming what is known as the *Southern Connecting Current*. The easterly movement of this current seems to be partly due to the westerly anti-trades, and partly to the excess of easterly momentum which is retained by the Brazil Current in its southward course from Cape St. Roque; whilst it partly depends also on the junction of an Antarctic current that flows N.E. from Cape Horn, meeting the Brazil Current off the estuary of La Plata, just as the Arctic Current meets the Gulf Stream off Newfoundland,—dense fogs being produced, in the one case as in the other, through the precipitation of the vapor overlying the Equatorial Current, by the colder air that overlies the Polar. On meeting the coast of South Africa, the Southern Connecting Current turns northwards, and runs towards the Bight of Biafra, forming the *South African Current*, the movement of which is partly sustained by the southerly winds which prevail along that coast, but is partly attributable to the indraught set up to supply the efflux of the Equatorial Current. In its passage thither, however, the part of it most distant from the land is draughted westwards by the southern trade, forming the most southerly portion of the equatorial drift. Between this and the Southern Connecting Current is a central space, lying between the parallels of 20° and 30° S., and the meridians of 0° and 25° W., over which there are no regular currents; and to this the name Sargasso Sea is sometimes applied by analogy, although its surface has no covering of seaweed.

Temperature of the Atlantic.—The distribution of surface temperature over the area of the Atlantic has now been made out with considerable accuracy; and it corresponds closely with what has been already stated as the course of the surface currents. There is, of course, a seasonal change, alike in its northern and in its southern division, this change being more and more marked as we recede from the equator. Following the course of the mean annual isotherms, however, we find that they cross the South Atlantic at nearly regular intervals, in an east and west direction, the principal departure from that direction being shown at their western end in the bend they take towards the south under the influence of the warm Brazil Current, and at their eastern in the still stronger bend they take towards the north under the influence of the cold South African Current, which reduces to about 75° the temperature of the southern equatorial that flows alongside the Guinea Current, whose temperature is 82° . In the North Atlantic, however, the influence of the movement of oceanic water on the surface-temperature is very much more marked. The annual isotherms, which cross the Sargasso Sea with nearly regular parallelism, and on the African side tend somewhat to the south, where they meet the colder water of the North African Current, show a strong northward bend on the American side,

along the early course of the Gulf Stream; but as its excess of temperature above that of the Atlantic generally diminishes as we trace it towards the Banks of Newfoundland, this northward deflection progressively becomes less. The marked contrast in temperature which is often there exhibited between two contiguous bands of water,—a thermometer hanging from a ship's bow showing a temperature of 70° , whilst another hanging from the stern shows only 40° ,—is due not so much to the elevation produced by the Gulf Stream as to the depression produced by the Arctic Current. This depression manifests itself in the southward bend given, on the American side; alike to the summer and the winter isotherms, beyond the summer isotherm of 70° and the winter isotherm of 60° , which may be considered as having nearly their normal position; whilst the northward tendency of these same isotherms on the European side not less conspicuously indicates a flow of warm water towards the western coasts of the British Isles, Norway, and even Iceland and Spitzbergen. It has been customary to regard this flow as an extension of the Gulf Stream; but if that term be limited (as it ought) to the current that issues from the Gulf of Mexico through the Florida Channel, the hypothesis is found to be untenable so soon as the thermal phenomena of that current are carefully examined. For, in the first place, the popular idea that the Gulf Stream retains its high temperature with little diminution during its passage first northwards and then eastwards is clearly disproved by observation.

From this it appears that, while the high surface-temperature with which the Gulf Stream leaves the Florida Channel is retained in summer with only 5° reduction as far as Nova Scotia, there is a reduction of 5° in winter during its northward passage to Cape Hatteras, and a further reduction of no less than 10° during its eastward passage from Cape Hatteras to Nova Scotia, making it a total reduction of 15° . In spring, again, there is a total reduction of 11° , and in autumn of 13° ; and in both cases the reduction during the eastward flow under the parallel of 35° N. is greater than the reduction in the northward flow from 25° N. to 35° N. The explanation of this is plainly to be found in the fact that in the early part of the course of the Gulf Stream its superheated stratum is a thick one, so that when its superficial film is cooled down by a superincumbent atmosphere of lower temperature, it is replaced by the uprising of a deeper stratum having nearly its original temperature. But as the stream spreads out superficially, its superheated stratum becomes proportionally thinner, and will consequently be more and more rapidly cooled down by the superincumbent atmosphere. Even supposing, therefore, that it were not subjected to any special cooling influence, it appears certain that, as the rate of the current slackens and its depth diminishes, the cooling process must continue at an increased rate, so as to bring down the surface-temperature of the stream to the normal isotherm of the locality, long before it could reach the shores of Europe. But it has been shown that when it passes Newfoundland the Gulf Stream is subjected to a special cooling influence—that of the Labrador Current with its fleet of icebergs, which melt away when borne into it; and this produces such an immediate reduction of its surface-temperature, that it thenceforth shows very little excess, although its sub-surface stratum still appears to be warmer than that of the ocean through which it flows.

But, further, the Gulf Stream, where it is last recognisable as a current, is flowing due east, and its southern portion turns first south-east and then south, whilst on the other hand, the course of the isothermal lines

clearly shows that the flow of warm water which carries them northward spreads across the whole breadth of the Atlantic, from the British Isles to Labrador, even extending up to the west of north into Baffin's Bay. When we contrast this immense body of north-moving water with the thinned-out film of what is by comparison a mere rivulet, it becomes obvious (1) that its northward flow cannot be attributable to the *vis a tergo* of the Florida Current, whilst (2) its convection of heat to the Arctic Sea cannot be accounted for by any amount of excess of temperature that is limited to a small depth, since the temperature of such a stratum, moving north-east at a rate of (at most) 4 or 5 miles per day, must soon be brought down to that of the atmosphere above it.

Influenced by these considerations, several eminent hydrographers, both British and American, have been disposed to deny, not only that the temperature of the North Atlantic is modified in any considerable degree by the true Gulf Stream, but that any other agency than that of warm S.W. winds is concerned in producing the climatic amelioration popularly attributed to it. They maintained, in fact, that the surface-temperature of the North Atlantic and Arctic Seas follows that of the superincumbent air,—the atmospheric temperature not being in any degree raised by that of warmer water beneath. This doctrine, however, is found to be inconsistent with the results of careful comparisons recently instituted between marine and atmospheric temperatures along the western coasts of Scotland, the Orkney, Shetland, and Faroe Islands, and especially with those obtained along the western coast of Norway. For it is found that during the winter months there is a constant excess of sea-temperature above that of the air, averaging 60.2 Fahr. along the western coast of Scotland and its islands, and rising to 140.5 at Fruholm near the North Cape. And it is also a very significant fact (ascertained by the careful inquiries of Mr. Buchan), that while the summer isotherms cross the British Islands nearly east and west (the temperature diminishing pretty regularly from south to north), the winter isotherms traverse them nearly north and south (the temperature diminishing from west to east); whilst in Ireland the isotherms seem to envelope the islands in their folds, which increase in warmth from the centre of the island to its sea-board. So in Norway the isothermal lines run parallel with the coast-line, and this alike in summer and winter,—the temperature falling in winter, and rising in summer, with the increase of distance from the sea. Nothing could prove more conclusively than such facts as these (taken in connection with the absence of ice in the harbors of Norway, even as far north as Hammerfest, through the whole winter) the dependence of the mild winter climate of the north-western coasts of Europe upon the proximity of a sea which is warmer than the superincumbent atmosphere; and we have now to inquire how this great N.E. movement of a stratum of warm water sufficiently thick to retain a surface-temperature considerably higher than that of the air above it is to be accounted for.

The solution of the problem seems to be afforded by the doctrine of a *General Oceanic Circulation*, sustained by opposition of temperature only, which was first distinctly propounded in 1845 by Professor Lenz of St. Petersburg, on the basis of observations made by him during the second voyage of Kotzebue (1825–1828). Others had been previously led to surmise that "Polar Currents" flow along the floors of the great oceans, even as far as the equator, balancing the superficial counter-currents which are observable in the opposite direction. But Lenz was led to conclude that the

whole of the deeper portion of the great ocean-basins in communication with the polar areas is occupied by polar water, which is constantly, though slowly, flowing towards the equator; whilst conversely the whole upper stratum of equatorial water is as constantly, though slowly, flowing towards one or both of the poles. And he particularly dwelt on the existence of a belt of water under the equator, colder than that which lies either north or south of it, as an evidence that polar water is there continually rising from beneath towards the surface,—a phenomenon which, he considered, admits of no other explanation. He further adduced the low salinity of equatorial water (previously noticed by Humboldt, and confirmed by his own observations), compared with that of tropical water, as evidence that the equatorial water of the surface is derived from the polar underflow. And he attributed the maintenance of this circulation to the continually renewed disturbance of equilibrium between the polar and equatorial columns,—the greater lateral (because downward) pressure of the former causing a *bottom outflow* of polar water in the direction of the latter, whilst the reduction of level thus occasioned will produce a *surface indraught* from the warmer towards the colder areas.

The doctrine of Lenz, so far from meeting with the general acceptance to which it had a fair claim,—alike on theoretical grounds and from its accordance with the facts ascertained by careful observation,—seems to have been put aside and forgotten, a preference being given to the doctrine of the prevalence of a uniform deep-sea temperature of 39° , which was supposed to be established by the thermometric observations made in the voyages of D'Urville and Sir James Ross. No such precaution, was taken in these observations as to that which Lenz had recourse, to obviate the effects of the tremendous pressure (1 ton per square inch for every 800 fathoms of depth) to which deep-sea thermometers are exposed; and it is now certain that the temperatures at great depths recorded by D'Urville and Ross were several degrees too high.

It was in entire ignorance of the doctrine of Lenz, and under the influence of that of D'Urville and Ross, which had been stamped with the great weight of Sir John Herschel's weight of authority, that Dr. Carpenter commenced in 1868 (in concert with Professor Wyville Thomson) a course of inquiry into the thermal condition of the deep sea, which at once convinced him of the fallacy of the uniform 39° doctrine, and led him to conclusions essentially accordant with those of Lenz. For in the channel of from 500 to 600 fathoms' depth between the north of Scotland and the Faroe Islands, they found the deeper half to be occupied by a stratum of glacial water, whose temperature ranged downward from 32° to $29^{\circ}.5$; whilst the upper half was occupied by a stratum warmer than the normal temperature of the latitudes. This phenomenon was interpreted by Carpenter as indicating a deep glacial flow from N.E. to S.W., and a warm upper flow from S.W. to N.E.; and finding that to the west of this channel, on the border of the deep Atlantic basin, the excess of warmth extended to a depth of more than 500 fathoms, he came to the conclusion that the north-moving stratum which brought it could not be an extension of the true Gulf Stream, but must be urged on by some much more general force. A series of temperature-soundings taken along the west of Ireland, the Bay of Biscay, and the coast of Portugal, confirmed him in this view, by showing that the division between an upper warm stratum and a cold under-stratum exists in the North Atlantic at a depth of from 700 to 900 fathoms, the whole mass of water below this having either flowed into the basin of the polar area, or having had its tem-

perature brought down from 39° to $36^{\circ}.5$ by mixture with the polar inflow. And this conclusion was confirmed by the result of temperature-soundings taken at corresponding depths and under the same parallels of latitude in the Mediterranean; for as they showed a uniform temperature of from 54° to 56° , from beneath the stratum of 100 fathoms that was superheated by direct insolation, to the very bottom, it became clear that depth *per se* could have no effect in reducing the bottom-temperature; and that the cause of the excess of temperature in the mass of water occupying the Mediterranean basin above that of Atlantic water at the same depths, lies in the seclusion of the former from the polar underflow which brings down the deep temperature of the latter. This conclusion having received marked confirmation from temperature soundings taken in the Eastern seas, was put forward by Carpenter as justifying the doctrine of a *vertical* oceanic circulation sustained by opposition of temperature only, quite independent of and distinct from the *horizontal* circulation produced by wind,—which doctrine he expressed in terms closely corresponding with those that had been used by Lenz. And the collection of data for the establishment or confutation of this doctrine was one of the objects of the "Challenger" expedition, which has already made, in the determination of the thermal stratification of the Atlantic between 38° N. lat. and 38° S. lat., what may fairly be characterised as the grandest single contribution ever yet made to terrestrial physics.

Distribution of Organic Life.—All that will be attempted under this head will be to indicate the general conditions that seem, from recent researches, to have the greatest influence on the distribution of plants and animals through this great oceanic basin.

The distribution of marine plants seems mainly determined by light, temperature, and depth,—a further influence being exerted by the character of the shores. The diminution of light in its passage through sea-water is so rapid, that the quantity which penetrates to a depth of 250 or 300 fathoms may be regarded as almost infinitesimal; and in conformity with this we find a very rapid diminution of Algal life below the depth of 100 fathoms. The upper stratum is occupied for the most part by the larger and coarser forms of the *Fucales*, or olive-green sea-weeds, whilst the more delicate *Ceramiales*, or red sea-weeds, frequent deeper waters; and, as it appears from experiments made in aquaria that the latter do not flourish in full light, but grow well in shadow, it may be concluded that their preference for a moderate depth is rather for reduced light and stillness than for depth *per se*. At a depth of 150 fathoms very few ordinary sea-weeds maintain their ground; and below this we seldom find any Algae, save the Corallines and Nullipores consolidated by calcareous deposit. The distribution of particular types over different parts of the Atlantic area appears to be mainly regulated by temperature; and this would seem to be remarkably the case with the floating *Diatomaceae*, which, though they form green bands in the surface-water of polar seas, have not been encountered in like abundance in the Atlantic, and do not contribute largely, by the subsidence of their siliceous *loricae*, to the composition of its bottom-deposit. Although it is the habit of the larger Algae to grow from a base of attachment (their roots serving no other purpose however, than that of anchorage), the enormous mass of Gulf-weed found in the Sargasso Sea seems quite independent of any such attachment. It was at one time supposed that this originally grew on the Bahama and Florida shores, and was torn thence by the powerful current of the Gulf Stream; but it seems certain that if such was its original source, the "Gulf-weed" now lives and propagates whilst freely

floating on the ocean-surface, having become adapted by various modifications to its present mode of existence.

The distribution of the animals that habitually live in that upper stratum of the ocean whose degree of warmth varies with the latitude, seems mainly determined by temperature. Thus the "right whale" of Arctic seas, and its representative in the Antarctic, seems never to enter the inter-tropical area, generally keeping away from even the temperate seas, whilst, on the other hand, the sperm whale ranges through the parts of the ocean where the "right-whales" are never seen.

The distribution of fishes seems generally to follow the same rule; as does also that of floating mollusks. Thus the little *Clio* (a Pteropod mollusk), which is a principal article of food of the "right whales" in polar seas, is rarely met with in the Atlantic, where, however, other pteropods, as *Hyalea*, present themselves in abundance. On the other hand, the warmer parts of its area swarm with Salpa-chains, which are not frequent in higher latitudes; and the few representatives of the Nautiloid Cephalopods, that were so abundant in Cretaceous seas, are now restricted to tropical or sub-tropical areas. And the distribution of the mollusks, echinoderms, and corals, which habitually live on the bottom, seems to be determined, within certain limits at least, by temperature rather than by depth.

The bathymetrical range to which animal life of any higher type than the Rhizopodal might extend, was until recently quite unknown; but the researches initiated by Prof. Wyville Thompson and Dr. Carpenter, in 1868, and since prosecuted by the "Challenger" expedition, have fully established the existence of a varied and abundant fauna in ocean-depths ranging downwards to 2000 fathoms. And these researches have further established that the distribution of this fauna is mainly determined by the temperature of the sea-bed; so that whilst in the channel between the north of Scotland and the Faroes there were found at the same depths, and within a few miles of each other, two faunæ almost entirely distinct—one a boreal and the other a warmer-temperate—on sea-beds having respectively the temperatures of 30° and 43°, various types to which a low temperature is congenial are traceable continuously along the whole abyssal sea-bed that intervenes between those northern and southern polar areas within which they present themselves at or near the surface. And hence it becomes clear that, since glacial types are even now being embedded in the strata which are in process of formation beneath the equator, no inferences as to terrestrial climate can be drawn from the character of marine deposits.

One very remarkable feature which presents itself over a large proportion of the Atlantic basin is the abundance of the minute *Globigerina* and other Foraminifera, the accumulation of whose shells, and of their disintegrated remains, is giving rise to a calcareous deposit of unknown thickness, that corresponds in all essential particulars to Chalk. This deposit, in some parts of the North Atlantic, is replaced by an Arctic drift of fine sand, whilst in other parts there is a mixture of arenaceous and of calcareous components, such as is found in certain beds of the Cretaceous formation. Now on the surface of this deposit there have been found so many living types, especially belonging to the groups of Echinoderms, Corals, Siliceous Sponges, and Foraminifera, which closely correspond with types hitherto regarded as characteristic of the Cretaceous epoch, that the question naturally suggests itself whether the existing are not the lineal descendants of the fossil types,—the differences they present being not greater than may be fairly attributed to the prolonged action of differences of temperature, food, pressure, &c.

And when these facts are taken in connection with those previously stated as to the probable remoteness of the period when (if ever) the present sea-bed of the Atlantic was dry land, the doctrine first put forth by Prof. Wyville Thomson, that there has been a continuous formation of Globigerina-mud on the bottom of the Atlantic from the Cretaceous epoch to the present time—or, in other words, that the formation of chalk on the sea-bed of the Atlantic did not cease with the elevation of the European area, but has been going on through the whole Tertiary period,—must be admitted as (to say the least) a not improbable hypothesis. That some considerable change took place at the conclusion of the Cretaceous epoch, by which the temperature of the upper stratum was lowered, so as to be no longer compatible with the existence of the fishes and chambered cephalopods characteristic of the Cretaceous fauna, may be fairly assumed from their disappearance; but this would not so much affect the deeper part of the basin, in which those lower types that seem more capable of adapting themselves to changes in external conditions would continue to hold their ground. That the like conditions had prevailed also through long previous geological periods, may be surmised from the persistence, over various parts of the Atlantic sea-bed, of the *Apiocrinite* type, which carries us back to the Oolitic formation, and of the *Pentacrinus* type, which has come down with very little alteration from the Liassic; whilst many existing *Terebratulida* do not differ more from Oolitic types than the latter differ among each other. Going back still further, we find in the persistence of certain Foraminiferal types from the Carboniferous limestone to the present time, and in the character of its deep-sea beds, a strong indication that they originated in a Foraminiferal deposit, representing in all essential particulars that which is now going on; while the persistence of the *Lingula* from the early Silurian strata to the present time suggests the question whether certain oceanic areas may not have remained in the condition of deep sea throughout the whole subsequent succession of geological changes.

ATLANTIS, ATALANTIS, or ATLANTICA, an island mentioned by Plato and other classical writers, concerning the real existence of which many disputes have been raised. In the *Timæus*, Critias relates how his grandfather Critias had been told by Solon some remarkable events in early Athenian history which he had learned from the Egyptian priests at Sais, whose records went much further back than the native accounts. "The most famous of all the Athenian exploits," Solon had been told, "was the overthrow of the island Atlantis. This was a continent lying over against the pillars of Hercules, in extent greater than Libya and Asia put together, and was the passage to other islands and to another continent, of which the Mediterranean Sea was only the harbor; and within the pillars the empire of Atlantis reached to Egypt and Tyrrhenia. This mighty power was arrayed against Egypt and Hellas and all the countries bordering on the Mediterranean. Then did your city bravely, and won renown over the whole earth, for at the peril of her own existence, and when the other Hellenes had deserted her, she repelled the invader, and of her own accord gave liberty to all the nations within the pillars. A little while afterwards there was a great earthquake, and your warrior race all sank into the earth; and the great island of Atlantis all disappeared into the sea. This is the explanation of the shallows which are found in that part of the Atlantic ocean." Such is the main substance of the principal account of the island furnished by the ancients,—an account which, if not entirely fictitious, belongs to the most nebulous region of history. The story may

embody some popular legend; and the legend may have rested on certain historical circumstances; but what these were it is (as the numerous theories advanced on the subjected may be held as proving) impossible now to determine.

ATLAS, in *Greek Mythology*, called sometimes a son of Japetus and the nymph Asia, or of Uranus and Gaia, and at other times traced to a different parentage, but always known as the being who supported on his shoulders the pillars on which the sky rested.

ATLAS, a mountain-chain of Northern Africa, between the great desert of the Sahara and the Mediterranean. The range has been but partially explored, and geographers differ as to its extent, some considering it to reach from Cape Ghir on the Atlantic to Cape Bon, the north-east point of Tunis, while others include under the name the whole mountain system between Cape Nun and the great Syrtis. In this latter sense it forms the mountain-land of the countries of Morocco, Algeria, Tunis, and Tripoli. It is composed of ranges and groups of mountains, enclosing well-watered and fertile valleys and plains, and having a general direction from W. to E. The highest peaks are supposed to attain an elevation of nearly 15,000 feet; and although none of them reach the height of perpetual snow, some of their loftiest summits are covered with snow during the greater part of the year. Mount Miltisn, 27 miles S.E. of the city of Morocco, was ascertained by Captain Washington to be 11,400 feet high. The greatest heights are in Morocco, from which point they appear to diminish in elevation as they extend towards the east.

ATMOSPHERE is the name applied to the invisible elastic envelope which surrounds the earth, the gaseous matter of which it is composed being usually distinguished by the name of air. Storms and weather generally, solar and terrestrial radiation, the disintegration of rocks, animal and vegetable life, twilight, and the propagation of sound, are some of the more striking phenomena which are either to a large extent or altogether dependent on the atmosphere. That air possesses weight may be shown by the simple experiment of taking a hollow globe filled with air and weighing it; then removing the contained air by means of an air-pump, and again weighing the globe, when it will be found to weigh less than at first. The difference of the two results is the weight of the air which has been removed. From Regnault's experiments, 100 cubic inches of dry air, or air containing no aqueous vapor, under a pressure of 30 English inches of mercury, and at a temperature of 60° Fahr., weigh 31.03529 grains; and since 100 cubic inches of distilled water at the same pressure and temperature weigh 25.252½ grains, it follows that air is 813.67 times lighter than water.

Air as an elastic fluid exerts pressure upon the earth or any substance on which it rests, the action of a boy's sucker and of a water-pump being familiar instances showing the pressure of the atmosphere. When air is removed from a water-pump, the water rises in the pump only to a certain height; for as soon as the water has risen to such a height that the weight of the column of water in the pump above the level of the surface of the water in the well just balances the pressure exerted by the atmosphere on the surface of the well, it ceases to rise. If the pressure of the atmosphere be increased, the water will rise higher in the pump; but if diminished, the level of the water will sink. The height to which the water rises within the pump thus varies with the pressure of the atmosphere, the height being generally about 34 feet. Since a given volume of mercury weighed *in vacuo* at a temperature of 62° Fahr. is 13.569 times heavier than the same volume of water it follows that a column of mercury will

rise *in vacuo* to a height 13.569 times less than a column of water, or about 30 inches. If we suppose, then, the height of the mercurial column to be 30 inches, which is probably near the average height of the barometer at sea-level, and its base equal to a square inch, it will contain 30 cubic inches of mercury; and since one cubic inch of mercury contains 3426.7 grains, the weight of 30 cubic inches will be nearly 14,7304 lb. avoirdupois. Thus the pressure of the atmosphere is generally at sea-level equal to 14.7304 lb. on each square inch of the earth's surface. Sir John Herschel has calculated that the total weight of an atmosphere averaging 30 inches of pressure is about 11⅓ trillions of pounds; and that, making allowance for the space occupied by the land above the sea, the mass of such an atmosphere is about $\frac{1}{1200000}$ part of the earth itself. This enormous pressure is exerted on the human frame in common with all objects on the earth's surface, and it is calculated that a man of the ordinary size sustains a pressure of about 14 tons; but as the pressure is exerted equally in all directions, and permeates the whole body, no inconvenience arises in consequence of it.

A pressure agreeing approximately with the average atmospheric pressure at sea-level is often used as a unit of pressure. This unit is called an *atmosphere*, and is employed in measuring pressures in steam engines and boilers. The value of this unit which has been adopted, in the metrical system, is the pressure of 760 millimètres (29.922 Eng. inches) of the mercurial column at 0° C. (32° Fahr.) at Paris, which amounts in that latitude to 1.033 kilogrammes on the square centimètre. In the English system, an *atmosphere* is the pressure due to 29.905 inches of the mercurial column at 32° Fahr. at London, amounting there to nearly 13¾ lb. weight on the square inch. The latter atmosphere is thus 0.99968 of that of the metrical system.

As regards the distribution of atmospheric pressure over the globe, there was little beyond conjecture, drawn from theoretical considerations, and for the most part erroneous, till the publication in 1868 of Buchan's memoir "On the Mean Pressure of the Atmosphere and the Prevailing Winds over the Globe." By the monthly isobaric charts and copious tables which accompanied the memoir, this important physical problem was first approximately solved. Since then the British Admiralty has published charts showing the mean pressure of the atmosphere over the ocean. The more important general conclusions regarding the geographical distribution of atmospheric pressure are the following:—

There are two regions of high pressure, the one north and the other south of the equator, passing completely round the globe as broad belts of high pressure. They enclose between them the low pressure of tropical regions, through the centre of which runs a narrower belt of still lower pressure, towards which the north and south trades blow. The southern belt of high pressure lies nearly parallel to the equator, and is of nearly uniform breadth throughout; but the belt north of the equator has a very irregular outline, and great differences in its breadth and in its inclination to the equator,—these irregularities being due to the unequal distribution of land and water in the northern hemisphere. Taking a broad view of the subject, there are only three regions of low pressure,—one round each pole, bounded by or contained within the belts of high pressure just referred to, and the equatorial belt of low pressure. The most remarkable of these, in so far as is yet known, is the region of low pressure surrounding the south pole, which appears to remain pretty constant during the whole year. The depression round the north pole is divided into two distinct centres, at each of which there is a diminution of pressure greatly lower than the average

north polar depression. These two centres lie in the north of the Atlantic and Pacific Oceans, respectively. The distribution of pressure in the different months of the year differs widely from the annual average, particularly in January and July, the two extreme months. In January the highest pressures are over the continents of the northern hemisphere, — and the larger the continental mass the greater the pressure, — and the lowest pressures are over the northern portions of the Atlantic and Pacific, South America and South Africa, and the Antarctic Ocean. In the centre of Asia the mean pressure of the atmosphere in this month is fully 30.400 inches, whereas in the North Atlantic, round Iceland, it is only 29.340 inches, or upwards of an inch lower than in Central Asia.

In July, on the other hand, the mean pressure of Central Asia is only 29.468 inches, or nearly an inch lower than during January; or, putting this striking result in other words, about a thirteenth of the pressure of the atmosphere is removed from the region during the hottest months of the year as compared with the winter season. The lowest pressures of the northern hemisphere are now distributed over the continents, and the larger the continental mass the greater is the depression.

Over the ocean, if we accept the higher latitudes, atmospheric pressure is more regular throughout the year than over the land. In the ocean to westwards of each of the continents there occurs at all seasons an area of high pressure, from 0.10 inch to 0.30 inch higher than what prevails on the coast westward of which it lies. The distance of these spaces of high pressure is generally about 30° of longitude; and their longitudinal axes lie, roughly speaking, about the zones of the tropics. The maximum is reached during the winter months, and these areas of high pressure are most prominently marked west of those continents which have the greatest breadth in 30° lat.; and the steepest barometric gradients are on their eastern side. It is scarcely possible to over-estimate the importance of these regions of high and low mean pressures, from their intimate bearing on atmospheric physics, but more particularly from their vital connection with prevailing winds and the general circulation of the atmosphere. This relation will be apprehended when it is considered that winds are simply the flowing away of the air from regions where there is a surplus (regions of high pressure) to where there is a deficiency of air (regions of low pressure). Everywhere over the globe this transference takes place in strict accordance with Buys-Ballot's "Law of the Winds," which may be thus expressed: — The wind neither blows round the space of lowest pressure in circles returning on themselves, nor does it blow directly toward that space; but it takes a direction intermediate, approaching, however, more nearly to the direction and course of circular curves than of radii to a centre. More exactly, the angle is not right angle, but from 45° to 80° . Keeping this relation between wind and the distribution of pressure in mind, the isobaric lines give the proximate causes of the prevailing winds over the globe, and through these the prominent features of climates. As regards the ocean, the prevailing winds indicate the direction of the drift-currents and other surface-currents, and thereby the anomalous distribution of the temperature of the sea as seen in the Chili, Guinea, and other ocean currents, and the peculiarly marked climates of the coasts past which these currents flow, are explained; for observations have now proved that the prevailing winds and surface-currents of all oceans are all but absolutely coincident.

As regards the annual march of pressure through the months of the year, curves representing it for the different regions of the earth differ from each other in every

conceivable way. It is only when the results are set down in their proper places on charts of the globe that the subject can be well understood. When thus dealt with, many of the results are characterised by great beauty and simplicity. Thus, of all influences which determine the barometric fluctuation through the months, the most important are the temperature, and through the temperature the humidity. Comparing, then, the average pressure in January with that in July, which two months give the greatest possible contrasts of temperature, the following is the broad result:—

Atmospheric pressure is more uniformly distributed over the globe in April and October than in any of the other months. In May and November, being the months immediately following, occur the great annual rise and fall of temperature; and since these rapid changes take place at very different rates, according to the relative distribution of land and water in each region, a comparison of the geographical distribution of May with that for the year brings out in strong relief the more prominent causes which influence climate, and some of the more striking results of these causes. This comparison shows a diminution of pressure in May over tropical and sub-tropical regions, including nearly the whole of Asia, the southern half of Europe, and the United States. An excess prevails over North America to the north of the Lakes, over Arctic America, Greenland, the British Isles, and to the north of a line passing through the English Channel in a north-easterly direction to the Arctic Sea. The excess in the southern hemisphere includes the southern half of South America and of Africa, the whole of Australia, and adjacent parts of the ocean. The influence of the land of the southern hemisphere, which in this month is colder than the surrounding seas, brings about an excess of pressure; on the other hand, the influence of land over those regions which are more immediately under the sun brings about a lower pressure, interesting examples of which occur in India, the Malayan Archipelago, and the Mediterranean, Black, and Caspian Seas. In many cases the lines of pressure follow more or less closely the contours of the coasts. Thus the diminution is greater over Italy and Turkey than over the Adriatic and Black Seas. The greatest diminution occurs in Central Asia, where it exceeds 0.200 inch, and the greatest excess round Iceland, where it exceeds 0.200 inch. It is to the position of Great Britain, with reference to the deficiency of pressure on the one hand and the excess on the other, that the general prevalence of east winds at this season is due. These easterly winds prevail over the whole of Northern Europe, as far south as a line drawn from Madrid and passing in a north-easterly direction through Geneva, Munich, &c. To the south of this line the diminution of pressure is less, and over this region the winds which are in excess are not easterly, but southerly. Crossing the Mediterranean, and advancing on Africa, we approach another region of lower pressure, towards which easterly and north-easterly winds again acquire the ascendancy, as at Malta, Algeria, &c.

This, in many cases great, variation of the pressure in the different months of the year must be kept carefully in view in deducting heights of places from observations made by travellers of the pressure of atmosphere, by the barometer or the temperature of boiling water. In reducing the observations, it is necessary to assume a sea-level pressure if the place is at a considerable distance from any meteorological observatory. Previous to the publication of Buchan's *Mean Pressure of the Atmosphere*, it appears that a mean sea-level pressure of 29.92 or 30.00 inches was in such cases universally assumed. The mean pressure at Barnaul, Siberia, being

29.536 inches in July, 30.293 inches in January, and 29.954 inches for the year, it follows that, by the former method of calculating the heights, observations made in January to ascertain the height of Lake Balkash would make the lake 350 feet too high, and observations made in July would make it 330 feet too low,—the difference of the two observations, each set being supposed to be made under the most favorable circumstances, and with the greatest accuracy, being 680 feet. This illustration will serve to account for many of the discrepancies met with in books regarding the heights of mountains and plateaus.

Of the periodical variations of atmospheric pressure, the most marked is the daily variation, which in tropical and sub-tropical regions is one of the most regular of recurring phenomena. In higher latitudes the diurnal oscillation is marked by the frequent fluctuations to which the pressure is subjected. If, however, hourly observations be regularly made for sometime, the hourly oscillation will become apparent. The results show two maxima occurring from 9 to 11 A.M. and 9 to 11 P.M., and two minima occurring from 3 to 6 A.M. and 3 to 6 P.M.

Though the diurnal calometric oscillations are among the best-marked of meteorological phenomena, at least in tropical and sub-tropical regions, yet none of these phenomena, except perhaps the electrical, could be named respecting whose geographical distribution so little is really known, whether as regards the amount of variation, the hour of occurrence of the critical phases, or, particularly, the physical causes on which the observed differences depend. This arises chiefly from the want of a sufficient number of ascertained facts; and to remedy this deficiency observations have, in the preparation of this present article, been collected and calculated from upwards of 250 places in different parts of the globe, and the data set down on charts. The chief results of this inquiry are the following, attention being entirely confined to the chief of oscillation, viz., that occurring from the A. M. maximum to the P. M. minimum.

Since the two maxima of daily pressure occur when the temperature is about the mean of the day, and the two minima when it is at its highest and lowest respectively, there is thus suggested a connection between the daily barometric oscillations and the daily march of temperature; and similarly a connection with the daily march of the amount of vapor and humidity of the air. The view entertained by many of the causes of the daily oscillations may be thus stated:—The *forenoon maximum* is conceived to be due to the rapidly increasing temperature, and the rapid evaporation owing to the great dryness of the air at this time of the day, and to the increased elasticity of the lowermost stratum of air which results therefrom, until a steady ascending current has set in. As the day advances, the vapor becomes more equally diffused upwards through the air, an ascending current, more or less strong and steady, is set in motion, a diminution of elasticity follows, and the pressure falls to the *afternoon minimum*. From this point the temperature declines, a system of descending currents set in, and the air of the lowermost stratum approaches more nearly the point of saturation, and from the increased elasticity, the pressure rises to the *evening maximum*. As the deposition of dew proceeds, and the fall of temperature and consequent downward movement of the air are arrested, the elasticity is again diminished, and pressure falls to the *morning minimum*. Since the view propounded some years ago, that if the elastic force of vapor be subtracted from the whole pressure, what remains will show only one daily maximum and minimum, has not been confirmed by observation, it follows

that the above explanation is quite insufficient to account for the phenomena; indeed, the view can be regarded in no other light than as a tentative hypothesis.

Singularly enough, Lamont and Broun, a few years ago, were led, independently of each other, to form an opinion that the daily barometric oscillations were due to the magneto-electric influence of the sun. It admits of no doubt, looking at the facts of the case so far as they have been disclosed, that the daily barometric oscillations originated with the sun, and that more than the sun's influence as exerted on the diurnal march of the temperature and humidity of the atmosphere is concerned in bringing them about. But from the facts adduced, it is equally certain that, be the originating cause what it may, its effects are enormously modified by the distribution of land and water over the globe, by the wind, and by the absolute and relative humidity of the atmosphere. The smallness of the amount of the summer oscillation from the forenoon maximum to the afternoon minimum over the North Atlantic as far south as lat. 30°, and its diminished amount, as far south at least as the equator, will no doubt play an important part in the unravelling of this difficulty.

One of the most important steps that could be taken would be an extensive series of observations from such countries as India, which offers such splendid contrasts of climate at all seasons, has a surface covered at one place with the richest vegetation, and at others with vast stretches of sandy deserts, and presents extensive plateaus and sharp ascending peaks—all which conditions are indispensable in collecting the data required for the solution of this vital problem of atmospheric physics.

The ancients thought that air was one of the four elements from which all things originated; this doctrine continued to prevail till 1774, when Priestly discovered oxygen gas, and showed it to be a constituent part of air. Nitrogen, the other constituent of air, first called *azote*, was discovered soon after, and the marked differences between these two gases could not fail to strike the most careless observer. It is remarkable that Scheele independently discovered both oxygen and nitrogen, and was the first to enunciate the opinion that air consists essentially of a mixture of these two gases. From experiments made by him to ascertain their relative volumes he concluded that the proportions are 27 volumes of oxygen and 73 volumes of nitrogen. It was left to Cavendish to show from 500 analyses that the relative proportions were practically constant, and that the proportion is 20.833 per cent. of oxygen. The results obtained by Cavendish, though not attended to for many years after they were published, have been shown by recent and more refined analyses to be wonderfully exact. The most recent analyses of specimens of air collected under circumstances which ensure that it is of average purity, give as a mean result the following:—

	Volume.
Oxygen.	20.96 per cent.
Nitrogen.	79.00 “
Carbonic acid	0.04 “
	100.00

The circumstances under which these proportions vary, and the other gases and substances which are found in the air, will be afterwards adverted to. Besides these three constituents of air, there is a fourth, viz., the vapor of water, from which no air, even at the lowest temperature yet observed is wholly free, so that absolutely dry air does not exist in the free atmosphere. The dry air of the atmosphere—oxygen (inclusive of ozone), nitrogen and carbonic acid—is always a gas

and its quantity is constant from year to year; but the vapor of water does not always remain in the gaseous state, and the quantity present in the atmosphere is, by the processes of evaporation and condensation, varying every instant. Water evaporates at all temperatures, even the lowest, and rises into the air in the form of an invisible elastic gas called aqueous vapor. The elasticity of vapor varies with the temperature.

The relative humidity of the air may be regarded as the degree of approach to saturation. It is greatest near the surface of the earth during night, when the temperature, being at or near the daily minimum, approaches the dew-point; it is also great in the morning, when the sun's rays have evaporated the dew, and the vapor is as yet only diffused a little way upwards; and it is least during the greatest heat of the day.

Between the humidity, both absolute and relative, of the air and the temperature there is a vital and all-important connection. Observation shows that when the quantity of vapor in the air is great, and also when the relative humidity is high, temperature falls little during the night, even though the sky be perfectly clear; but when the quantity of vapor is small, or the relative humidity is low, temperature rapidly falls. On the other hand, during the day the temperature rises slowly, when the quantity of vapor is great, or relative humidity high, even though the sky be clear, but when the quantity of vapor is small, and humidity low, temperature rapidly rises. These facts are explained by the circumstance that perfectly dry air is diathermanous, that is, it allows radiant heat to pass through it without being sensibly warmed thereby. Add vapor to this air, and its diathermancy is diminished. The diathermancy is also reduced if the temperature approach nearer to the dew-point; in other words, if the relative humidity be increased. Hence, with an increase of vapor or with increased humidity, the effects of both solar and terrestrial radiation are much less felt on the surface of the earth—the vapor screen performing, in truth, one of the most important conservative functions of the atmosphere.

Since ascending currents fall in temperature as they ascend, through diminished pressure and consequent dilatation, they increase their relative humidity; and since descending currents increase in temperature, and consequently reduce their relative humidity, it follows that, over a region from which ascending currents rise, solar and terrestrial radiation is very considerably obstructed, but over a region upon which currents descend, radiation is much less obstructed. Most of our exceptionally hot summer and cold winter weather is to be explained in this way, on which occasions there is generally observed a high barometric pressure overspreading a comparatively limited region, on which a slow downward movement of the air proceeds.

Of the solar heat which reaches the surface of the globe, that part which falls on the land may be regarded as wholly absorbed by the thin superficial layer exposed to the heating rays; and since there is no mobility in the particles of the land, the heat can be communicated downwards only by conduction. On the other hand, the solar heat which falls on water is not, as in the case of land, arrested at the surface, but penetrates to a considerable depth, the heating effect being in the case of clear water appreciably felt at a depth of from 500 to 600 feet. Since the heat daily received by the ocean from the sun is diffused downwards through a very considerable depth, the surface of the ocean on which the atmosphere rests is much less heated during the day than is the surface of the land. Similarly it is also less cooled during the night by terrestrial radiation.

This points to a chief acting force on which the great

movements of the atmosphere depend, viz., simultaneous local irregularities in the distribution of temperature in the atmosphere. The local expansion of the atmosphere by heat during the day is greatest over land, where the air is clear, dry, and comparatively calm, and least over the ocean, where the sky is clouded, and the air loaded with moisture. On the other hand, the local contraction by cold during night is greatest over land, where the air is clear, dry, and calm, or nearly so, and least over the ocean, where the air is clouded, and loaded with moisture. As familiar illustrations of atmospheric movements resulting from local expansions by heat and contractions by cold, we may refer to the land and sea breezes, and what depend upon exactly the same principle, the dry and rainy monsoons in different parts of the globe. But the illustration of the principle on the broadest scale is the system of atmospheric circulation known as the equatorial and polar currents of the atmosphere, which originate in the unequal heating by the sun of the equatorial, temperate, and polar regions.

The other principal motive force in atmospheric circulation depends on the aqueous vapor. The many ways in which this element acts as a motive force will be seen when it is considered that a large quantity of sensible heat disappears in the process of evaporation, and reappears in the process of condensation of the vapor into rain or cloud; that saturated air is specifically lighter than dry air; and that the absolute and relative amount of the vapor powerfully influences both solar and terrestrial radiation. The question to be carefully considered here is how in these ways the vapor produces local irregularities in the distribution of atmospheric pressure, thus giving rise to aerial movements which set in to restore the equilibrium which has thus been disturbed.

It is from these local irregularities—using the word local in a very wide sense—in the distribution of atmospheric pressure, whether the irregularities originate in the temperature or aqueous vapor, that all winds, from the lightest breeze to the most destructive hurricane, take their rise; for, as already stated, wind is merely the flowing away of the air from where there is a surplus of it to where there is a deficiency.

In examining weather charts embracing a considerable portion of the earth's surface, there are seen two different systems of pressure, changing their forms and positions on the globe from day to day—one set being systems of low pressure marked off by concentric isobars enclosing pressures successively lower as the central space is approached, and the other set being systems of high pressure marked off by roughly concentric isobars bounding pressures successively higher towards their centres. These two systems are essentially distinct from each other, and without some knowledge of them the circulation of the atmosphere cannot be understood.

Observations of the winds cannot be conducted, and the results discussed, on the supposition that the general movement of the winds felt on the earth's surface is horizontal, it being evident that the circulation of the atmosphere is effected largely through systems of ascending and descending currents. The only satisfactory way of discussing the winds, viewed especially in their climatic relations, is that recently proposed by Köppen of St. Petersburg, and applied by him with very fruitful results in investigating the weather of that place during 1872 and 1873. In attempting an explanation of these phenomena, we are met with several as yet insuperable obstacles:—(1.) An imperfect knowledge of the mode of formation and propagation of low-pressure systems; (2.) Imperfect knowledge of the relations of the formation of cloud and aqueous precipita-

tion to barometric fluctuations; (3.) A want of information with reference to the merely mechanical effects of ascending, descending, and horizontal currents of air on the barometric pressure; in other words we do not know how far the barometric pressure is an indication of the mass of air in the column vertically over it, when that column is traversed by air-currents; (4.) An almost total absence of really good wind observations; and (5.) Deficient information in nearly everything that respects aqueous vapor—its relation to radiant heat, both solar and terrestrial; its mode of diffusion vertically and horizontally in the free atmosphere, especially from an evaporating surface; the influence which its condensation into cloud and rain exerts on aerial currents,—in regard to all which more satisfactory methods of observing this vital element, and discussing the results of observation, are greatly to be desired. There are here large important fields of inquiry awaiting experimental and observational physicists.

The law of the dilatation of gases, known as the "Law of Boyle" or "Law of Mariotte," is this: The volume occupied by a gas is in reverse ratio to the pressure under which it exists, if the temperature remains the same; or the density of a gas is proportioned to its pressure. Consequently, air under a pressure equal to that of two atmospheres will occupy only half the volume it occupied under the pressure of one atmosphere; under the pressure of three atmospheres, one-third of that volume, &c. By doubling the pressure we double the elasticity. If, however, the temperature be increased, and the air occupy the same space, the pressure will be increased; but if the pressure is to remain the same, the air must occupy a larger space. From Regnault's experiments, it is concluded that the co-efficient which denotes increase of elasticity for 1° Fahr. of air whose volume is constant equals .002036; and that the co-efficient which denotes increase of volume for 1° Fahr. of air whose elasticity is constant equals .002039.

These portions of the atmosphere in contact with the earth are pressed upon by all the air above them. The air at the top of a mountain is pressed upon by all the air above it, while all the portion below it, or lying between the top of the mountain and the surface of the sea, exerts no pressure whatever upon it. Thus the pressure of the atmosphere constantly diminishes with the height. If, then, the pressure of the atmosphere at two heights be observed, and if at the same time the mean temperature and humidity of the whole stratum of air lying between the two levels were known, the difference in height between the two places could be calculated. For the development of this principle, see BAROMETRIC MEASUREMENTS OF HEIGHTS.

The air thus diminishing in density as we ascend, if it consists of ultimate atoms, as is no doubt the case, it follows that the limit of the atmosphere will be reached at the height where the force of gravity downwards upon a single particle is equal to the resisting force arising from the repulsive force of the particles. It was long supposed, from the results of observations on the refraction of light, that the height of the atmosphere did not exceed 45 miles; but from the observations of luminous meteors, whose true character as cosmical bodies was established a few hundred years ago, it is inferred that the height of the atmosphere is at least 120 miles, and that, in an extremely attenuated form, it may even reach 200 miles.

Great differences have been observed by Dr. A. Smith between country rain and town rain: country rain is neutral; town rain, on the other hand, is acid, and corrodes metals, and even stones and bricks, destroying mortar rapidly, and readily spoiling many colors. Much information has been obtained regarding impuri-

ties in the air of towns and other places by examining the rain collected in different places. The air freest from impurities is that collected at the sea-coast and at considerable heights. Again, ammonia is found to diminish, while nitric acid increases, in ascending to, at least, habitable heights. As regards organic matter in the air, it corresponds to a considerable extent with the density of the population. As might have been supposed from the higher temperature, more nitric acid is contained in rain collected on the Continent than in the British Islands. This inquiry, which is only yet in its infancy, will doubtless continue to be vigorously prosecuted, particularly since we may hope thereby to arrive at the means of authoritatively defining the safe limits of the density of population, and the extent to which manufactures may be carried on within a given area. The influence of atmospheric impurities on the public health has received a good deal of attention.

The relation of weather to mortality is a very important inquiry, and though a good deal has been known regarding the question for some time, yet it has only recently been systematically inquired into. Considering the weather of the year as made up of several distinct climates differing from each other according to temperature and moisture and their relations to each other, it may be divided into six distinct climates, characterised respectively by cold, cold with dryness, dryness with heat, heat, heat with moisture, and cold with moisture. Each of these six periods has a peculiar influence in increasing or diminishing the mortality, and each has its own group of diseases which rise to the maximum, or fall to the minimum mortality, or are subject to a rapid increase or a rapid decrease. The mortality from all causes and at all ages shows a large excess above the average from the middle of November to the middle of April, from which it falls to the minimum in the end of May; it then slowly rises, and on the third week of July suddenly shoots up almost as high as the winter maximum of the year, at which it remains till the second week of August, falling thence as rapidly as it rose to a secondary minimum in October. Regarding the summer excess, which is so abrupt in its rise and fall, it is almost altogether due to the enormous increase of the mortality among mere infants under one year of age; and this increase is due not only to deaths at one age, but to deaths from one class of diseases, viz., bowel complaints. If the deaths from bowel complaints be deducted from the deaths from all causes, there remains an excess of deaths in the cold months, and a deficiency in the warm months. In other words, the curve of mortality is regulated by the large number of deaths from diseases of the respiratory organs.

ATMOSPHERIC RAILWAY, a railway in which the pressure of air is used directly or indirectly to propel carriages, as a substitute for steam. It was devised at a time when the principles of propulsion were not so well understood as they are now, and when the dangers and inconveniences attendant on the use of locomotives were very much exaggerated. It had been long known that small objects could be propelled for great distances through tubes by air pressure, but a Mr. Vallance, of Brighton, seems to have been the first to propose the application of this system to passenger traffic. He projected (about 1825) an atmospheric railway, consisting of a wooden tube about 6 feet 6 inches in diameter, with a carriage running inside it. A diaphragm fitting the tube, approximately air-tight, was attached to the carriage, and the air exhausted from the front of it by a stationary engine, so that the atmospheric pressure behind drove the carriage forward. Later inventors, commencing with Henry Pinkus (1835), for the most part kept the carriages altogether outside the tube, and

connected them by a bar with a piston working inside it, this piston being moved by atmospheric pressure in the way just mentioned. The tube was generally provided with a slot upon its upper side, closed by a continuous valve or its equivalent, and arrangements were made by which this valve should be opened to allow the passage of the driving bar without permitting great leakage of air. About 1840, Messrs. Clegg & Samuda made various experiments with an atmospheric tube constructed on this principle upon a portion of the West London Railway, near Wormwood Scrubs. The apparent success of these induced the Dublin and Kingstown Railway to adopt Clegg & Samuda's scheme upon an extension of their line from Kingstown to Dalkey, where it was in operation in 1844. Later on, the same system was adopted on a part of the South Devon line and in several other places, and during the years 1844-1846 the English and French patent records show a very large number of more or less practicable and ingenious schemes for the tubes, valves, and driving gear of atmospheric railways. The atmospheric system was nowhere permanently successful, but in all cases was eventually superseded by locomotives, the last atmospheric line being probably that at St. Germain, which was worked until 1862.

ATOM is a body which cannot be cut in two. The atomic theory is a theory of the constitution of bodies which asserts that they are made up of atoms. The opposite theory is that of the homogeneity and continuity of bodies, and asserts, at least in the case of bodies having no apparent organisation, such, for instance, as water, that as we can divide a drop of water into two parts which are each of them drops of water, so we have reason to believe that these smaller drops can be divided again, and the theory goes on to assert that there is nothing in the nature of things to hinder this process of division from being repeated over and over again, times without end. This is the doctrine of the infinite divisibility of bodies, and it is in direct contradiction with the theory of atoms.

The atomists assert that after a certain number of such divisions the parts would be no longer divisible, because each of them would be an atom. The advocates of the continuity of matter assert that the smallest conceivable body has parts, and that whatever has parts may be divided.

In ancient times Democritus was the founder of the atomic theory, while Anaxagoras propounded that of continuity, under the name of the doctrine of homœomeria, or of the similarity of the parts of a body to the whole. The arguments of the atomists, and their replies to the objections of Anaxagoras, are to be found in Lucretius.

In modern times the study of nature has brought to light many properties which appear to depend on the magnitude and motions of their ultimate constituents, and the question of the existence of atoms has once more become conspicuous among scientific inquiries.

We shall begin by stating the opposing doctrines of atoms and of continuity before giving an outline of the state of molecular science as it now exists. In the earliest times the most ancient philosophers whose speculations are known to us seem to have discussed the ideas of number and of continuous magnitude, of space and time, of matter and motion, with a native power of thought which has probably never been surpassed. Their actual knowledge, however, and their scientific experience were necessarily limited, because in their days the records of human thought were only beginning to accumulate. It is probable that the first exact notions of quantity were founded on the consideration of number. It is by the help of numbers that concrete

quantities are practically measured and calculated. Now, number is discontinuous. We pass from one number to the next *per saltum*. The magnitudes, on the other hand, which we meet with in geometry, are essentially continuous. The attempt to apply numerical methods to the comparison of geometrical quantities led to the doctrine of incommensurables, and to that of the infinite divisibility of space. Meanwhile, the same considerations had not been applied to time, so that in the days of Zeno of Elea time was still regarded as made up of a finite number of "moments," while space was confessed to be divisible without limit. This was the state of opinion when the celebrated arguments against the possibility of motion, of which that of Achilles and the tortoise is a specimen, were propounded by Zeno, and such, apparently, continued to be the state of opinion till Aristotle pointed out that time is divisible without limit, in precisely the same sense that space is. And the slowness of the development of scientific ideas may be estimated from the fact that Bayle does not see any force in this statement of Aristotle, but continues to admire the paradox of Zeno. Thus the direction of true scientific progress was for many ages towards the recognition of the infinite divisibility of space and time.

It was easy to attempt to apply similar arguments to matter. If matter is extended and fills space, the same mental operation by which we recognise the divisibility of space may be applied, in imagination at least, to the matter which occupies space. From this point of view the atomic doctrine might be regarded as a relic of the old numerical way of conceiving magnitude, and the opposite doctrine of the infinite divisibility of matter might appear for a time the most scientific. The atomists, on the other hand, asserted very strongly the distinction between matter and space. The atoms, they said, do not fill up the universe; there are void spaces between them. If it were not so, Lucretius tells us, there could be no motion, for the atom which gives way first must have some empty place to move into.

The opposite school maintained then, as they have always done, that there is no vacuum—that every part of space is full of matter, that there is a universal plenum, and that all motion is like that of a fish in water, which yields in front of the fish because the fish leaves room for it behind.

Of the different forms of the atomic theory, that of Boscovich may be taken as an example of the purest monadism. According to Boscovich matter is made up of atoms. Each atom is an indivisible point, having position in space, capable of motion in a continuous path, and possessing a certain mass, whereby a certain amount of force is required to produce a given change of motion. Besides this the atom is endowed with potential force, that is to say, that any two atoms attract or repel each other with a force depending on their distance apart. The law of this force, for all distances greater than say the thousandth of an inch, is an attraction varying as the inverse square of the distance. For smaller distances the force is an attraction for one distance and a repulsion for another, according to some law not yet discovered. Boscovich himself, in order to obviate the possibility of two atoms ever being in the same place, asserts that the ultimate force is a repulsion which increases without limit as the distance diminishes without limit, so that two atoms can never coincide. But this seems an unwarrantable concession to the vulgar opinion that two bodies cannot co-exist in the same place. This opinion is deduced from our experience of the behavior of bodies of sensible size, but we have no experimental evidence that two atoms may not sometimes coincide. For instance, if oxygen and hydrogen combine to form

water, we have no experimental evidence that the molecule of oxygen is not in the very same place with the two molecules of hydrogen. Many persons cannot get rid of the opinion that all matter is extended in length, breadth, and depth. This is a prejudice of the same kind with the last, arising from our experience of bodies consisting of immense multitudes of atoms. The system of atoms, according to Boscovich, occupies a certain region of space in virtue of the forces acting between the component atoms of the system and any other atoms when brought near them. No other system of atoms can occupy the same region of space at the same time, because, before it could do so, the mutual action of the atoms would have caused a repulsion between the two systems insuperable by any force which we can command. Thus, a number of soldiers with firearms may occupy an extensive region to the exclusion of the enemy's armies, though the space filled by their bodies is but small. In this way Boscovich explained the apparent extension of bodies consisting of atoms, each of which is devoid of extension. According to Boscovich's theory, all action between bodies is action at a distance. There is no such thing in nature as actual contact between two bodies. When two bodies are said in ordinary language to be in contact, all that is meant is that they are so near together that the repulsion between the nearest pairs of atoms belonging to the two bodies is very great.

Thus, in Boscovich's theory, the atom has continuity of existence in time and space. At any instant of time it is at some point of space, and it is never in more than one place at a time. It passes from one place to another along a continuous path. It has a definite mass which cannot be increased or diminished. Atoms are endowed with the power of acting on one another by attraction or repulsion, the amount of the force depending on the distance between them. On the other hand, the atom itself has no parts or dimensions. In its geometrical aspect it is a mere geometrical point. It has no extension in space. It has not the so-called property of Impenetrability, for two atoms may exist in the same place. This we may regard as one extreme of the various opinions about the constitution of bodies.

The opposite extreme, that of Anaxagoras—the theory that bodies apparently homogeneous and continuous are so in reality—is, in its extreme form, a theory incapable of development. To explain the properties of any substance by this theory is impossible. We can only admit the observed properties of such substance as ultimate facts. There is a certain stage, however, of scientific progress in which a method corresponding to this theory is of service. In hydrostatics, for instance, we define a fluid by means of one of its known properties, and from this definition we make the system of deductions which constitute the science of hydrostatics. In this way the science of hydrostatics may be built upon an experimental basis without any consideration of the constitution of a fluid as to whether it is molecular or continuous. In like manner, after the French mathematicians had attempted, with more or less ingenuity, to construct a theory of elastic solids from the hypothesis that they consist of atoms in equilibrium under the action of their mutual forces, Stokes and others showed that all the results of this hypothesis, so far at least as they agreed with facts, might be deduced from the postulate that elastic bodies exist, and from the hypothesis that the smallest portions into which we can divide them are sensibly homogeneous. In this way the principle of continuity, which is the basis of the method of Fluxions and the whole of modern mathematics, may be applied to the analysis of problems connected with material bodies by assuming

them, for the purpose of this analysis, to be homogeneous. All that is required to make the result applicable to the real case is that the smallest portions of the substance of which we take any notice shall be sensibly of the same kind. Thus, if a railway contractor has to make a tunnel through a hill of gravel, and if one cubic yard of the gravel is so like another cubic yard that for the purposes of the contract they may be taken as equivalent, then, in estimating the work required to remove the gravel from the tunnel, he may, without fear of error, make his calculations as if the gravel were a continuous substance. But if a worm has to make his way through the gravel, it makes the greatest possible difference to him whether he tries to push right against a piece of gravel, or directs his course through one of the intervals between the pieces; to him, therefore, the gravel is by no means a homogeneous and continuous substance.

In the same way, a theory that some particular substance, say water, is homogeneous and continuous may be a good working theory up to a certain point, but may fail when we come to deal with quantities so minute or so attenuated that their heterogeneity of structure comes into prominence. Whether this heterogeneity of structure is or is not consistent with homogeneity and continuity of substance is another question.

The extreme form of the doctrine of continuity is that stated by Descartes, who maintains that the whole universe is equally full of matter, and that this matter is all of one kind, having no essential property besides that of extension. All the properties which we perceive in matter he reduces to its parts being movable among one another, and so capable of all the varieties which we can perceive to follow from the motion of its parts. Descartes' own attempts to deduce the different qualities and actions of bodies in this way are not of much value. More than a century was required to invent methods of investigating the conditions of the motion of systems of bodies such as Descartes imagined. But the hydrodynamical discovery of Helmholtz that a vortex in a perfect liquid possesses certain permanent characteristics, has been applied by Sir W. Thomson to form a theory of vortex atoms in a homogeneous, incompressible, and frictionless liquid, to which we shall return at the proper time.

OUTLINE OF MODERN MOLECULAR SCIENCE, AND IN PARTICULAR OF THE MOLECULAR THEORY OF GASES.

We begin by assuming that bodies are made up of parts, each of which is capable of motion, and that these parts act on each other in a manner consistent with the principle of the conservation of energy. In making these assumptions, we are justified by the facts that bodies may be divided into smaller parts, and that all bodies with which we are acquainted are conservative systems, which would not be the case unless their parts were also conservative systems.

We may also assume that these small parts are in motion. This is the most general assumption we can make, for it includes, as a particular case, the theory that the small parts are at rest. The phenomena of the diffusion of gases and liquids through each other show that there may be a motion of the small parts of a body which is not perceptible to us.

We make no assumption with respect to the nature of the small parts—whether they are all of one magnitude. We do not even assume them to have extension and figure. Each of them must be measured by its mass, and any two of them must, like visible bodies, have the power of acting on one another when they come near enough to do so. The properties of the

body, or medium, are determined by the configuration and motion of its small parts.

The effect of the direct action of the molecules on each other depends on the number of pairs of molecules which at a given instant are near enough to act on one another. The number of such pairs is proportional to the square of the number of molecules in unit of volume, that is, to the square of the density of the gas. Hence, as long as the medium is so rare that the encounter between two molecules is not affected by the presence of others, the deviation from Boyle's law will be proportional to the square of the density. If the action between the molecules is on the whole repulsive, the pressure will be greater than that given by Boyle's law. If it is, on the whole, attractive, the pressure will be less than that given by Boyle's law. It appears, by the experiments of Regnault and others, that the pressure does deviate from Boyle's law when the density of the gas is increased. In the case of carbonic acid and other gases which are easily liquefied, this deviation is very great. In all cases, however, except that of hydrogen, the pressure is less than that given by Boyle's law, showing that the virial is on the whole due to attractive forces between the molecules.

Another kind of evidence as to the nature of the action between the molecules is furnished by an experiment made by Dr. Joule. Of two vessels, one was exhausted and the other filled with a gas at a pressure of 20 atmospheres; and both were placed side by side in a vessel of water, which was constantly stirred. The temperature of the whole was observed. Then a communication was opened between the vessels, the compressed gas expanded to twice its volume, and the work of expansion, which at first produced a strong current in the gas, was soon converted into heat by the internal friction of the gas. When all was again at rest, and the temperature uniform, the temperature was again noted. In Dr. Joule's first experiments the observed temperature was the same as before. In a series of experiments, conducted by Dr. Joule and Sir W. Thomson on a different plan, by which the thermal effect of free expansion can be more accurately measured, a slight cooling effect was observed in all the gases examined except hydrogen. Since the temperature depends on the velocity of agitation of the molecules, it appears that when a gas expands without doing external work the velocity of agitation is not much affected, but that in most cases it is slightly diminished. Now if the molecules during their mutual separation act on each other their velocity will increase or diminish according as the force is repulsive or attractive. It appears from the experiments on the free expansion of gases, that the force between the molecules is small, but on the whole attractive. Having thus justified the hypothesis that a gas consists of molecules in motion, which act on each other only when they come very close together during an encounter, but which during the intervals between their encounters which constitute the greater part of their existence, are describing free paths, and are not acted on by any molecular force, we proceed to investigate the motion of such a system.

The mathematical investigation of the properties of such a system of molecules in motion is the foundation of molecular science. Clausius was the first to express the relation between the density of the gas, the length of the free paths of its molecules, and the distance at which they encounter each other. He assumed, however, at least in his earlier investigations, that the velocities of all the molecules are equal. The mode in which the velocities are distributed was first investigated by the present writer, who showed that in the moving system the velocities of the molecules range from zero to

infinity, but that the number of molecules whose velocities lie within given limits can be expressed by a formula identical with that which expresses in the theory of errors the number of errors of observation lying within corresponding limits.

The mean kinetic energy of a molecule, however, has a definite value, which is easily expressed in terms of the quantities which enter into the expression for the distribution of velocities. The most important result of this investigation is that when several kinds of molecules are in motion and acting on one another, the mean kinetic energy of a molecule is the same whatever be its mass, the molecules of greater mass having smaller mean velocities. Now, when gases are mixed their temperatures become equal. Hence we conclude that the physical condition which determines that the temperature of two gases shall be the same is that the mean kinetic energies of agitation of the individual molecules of the two gases are equal. This is of great importance in the theory of heat, though we are not yet able to establish any like result for bodies in the liquid or solid state.

Our definition of a molecule is purely dynamical. A molecule is that minute portion of a substance which moves about as a whole, so that its parts, if it has any, do not part company during the motion of agitation of the gas. The result of the kinetic theory, therefore, is to give us information about the relative masses of molecules considered as moving bodies. The consistency of this information with the deductions of chemists from the phenomena of combination, greatly strengthens the evidence in favor of the actual existence and motion of gaseous molecules.

Another confirmation of the theory of molecules is derived from the experiments of Dulong and Petit on the specific heat of gases, from which they deduced the law which bears their name, and which asserts that the specific heats of equal weights of gases are inversely as their combining weights, or, in other words, that the capacities for heat of the chemical equivalents of different gases are equal.

The determination of the molecular volume of a gas is subject as yet to considerable uncertainty. The most obvious method is that of compressing the gas till it assumes the liquid form. It seems probable, from the great resistance of liquids to compression, that their molecules are at about the same distance from each other as that at which two molecules of the same substance in the gaseous form act on each other during an encounter. If this is the case, the molecular volume of a gas is somewhat less than the volume of the liquid into which it would be condensed by pressure, or, in other words, the density of the molecules is somewhat greater than that of the liquid.

The first numerical estimate of the diameter of a molecule was that made by Loschmidt in 1865 from the mean path and the molecular volume. Independently of him and of each other, Mr. Stoney, in 1868, and Sir W. Thomson, in 1870, published results of a similar kind—those of Thomson being deduced not only in this way, but from considerations derived from the thickness of soap bubbles, and from the electric action between zinc and copper.

The diameter and the mass of a molecule, as estimated by these methods, are, of course, very small, but by no means infinitely so. About two millions of molecules of hydrogen in a row would occupy a millimetre, and about two hundred million million million of them would weigh a milligramme. These numbers must be considered as exceedingly rough guesses; they must be corrected by more extensive and accurate experiments as science advances; but the main result, which appears to be well established, is that the determination of the

mass of a molecule is a legitimate object of scientific research, and that this mass is by no means immeasurably small.

Ioschmidt illustrates these molecular measurements by a comparison with the smallest magnitudes visible by means of a microscope. Nobert, he tells us, can draw 4000 lines in the breadth of a millimetre. The intervals between these lines can be observed with a good microscope. A cube, whose side is the 400th of a millimetre, may be taken as the *minimum visible* for observers of the present day. Such a cube would contain from 60 to 100 million molecules of oxygen or of nitrogen; but since the molecules of organised substances contain on an average about 50 of the most elementary atoms, we may assume that the smallest organised particle visible under the microscope contains about two million molecules of organic matter. At least half of every living organism consists of water, so that the smallest living being visible under the microscope does not contain more than about a million organic molecules. Some exceedingly simple organism may be supposed built up of not more than a million similar molecules. It is impossible, however, to conceive so small a number sufficient to form a being furnished with a whole system of specialised organs.

Thus molecular science sets us face to face with physiological theories. It forbids the physiologist from imagining that structural details of infinitely small dimensions can furnish an explanation of the infinite variety which exists in the properties and functions of the most minute organisms.

A microscopic germ is, we know, capable of development into a highly organised animal. Another germ, equally microscopic, becomes, when developed, an animal of a totally different kind. Do all the differences, infinite in number, which distinguish the one animal from the other, arise each from some difference in the structure of the respective germs? Even if we admit this as possible, we shall be called upon by the advocates of Pangenesis to admit still greater marvels. For the microscopic germ, according to this theory, is no mere individual, but a representative body, containing members collected from every rank of the longdrawn ramification of the ancestral tree, the number of these members being amply sufficient not only to furnish the hereditary characteristics of every organ of the body and every habit of the animal from birth to death, but also to afford a stock of latent gemmules to be passed on in an inactive state from germ to germ, till at last the ancestral peculiarity which it represents is revived in some remote descendant.

Some of the exponents of this theory of heredity have attempted to elude the difficulty of placing a whole world of wonders within a body so small and so devoid of visible structure as a germ, by using the phrase structureless germs. Now, one material system can differ from another only in the configuration and motion which it has at a given instant. To explain differences of function and development of a germ without assuming differences of structure is, therefore, to admit that the properties of a germ are not those of a purely material system.

The evidence as to the nature and motion of molecules, with which we have hitherto been occupied, has been derived from experiments upon gaseous media, the smallest sensible portion of which contains millions of millions of molecules. The constancy and uniformity of the properties of the gaseous medium is the direct result of the inconceivable irregularity of the motion of agitation of its molecules. Any cause which could introduce regularity into the motion of agitation, and marshal the molecules into order and method in their

evolutions, might check or even reverse that tendency to diffusion of matter, motion, and energy, which is one of the most invariable phenomena of nature, and to which Thomson has given the name of the dissipation of energy.

Thus, when a sound-wave is passing through a mass of air, this motion is of a certain definite type, and if left to itself the whole motion is passed on to other masses of air, and the sound-wave passes on, leaving the air behind it at rest. Heat, on the other hand, never passes out of a hot body, except to enter a colder body, so that the energy of sound-waves, or any other form of energy which is propagated so as to pass wholly out of one portion of the medium and into another, cannot be called heat.

We have now to turn our attention to a class of molecular motions, which are as remarkable for their regularity as the motion of agitation is for its irregularity.

It has been found, by means of the spectroscope, that the light emitted by incandescent substances is different according to their state of condensation. When they are in an extremely rarefied condition the spectrum of their light consists of a set of sharply-defined bright lines. As the substance approaches a denser condition the spectrum tends to become continuous, either by the lines becoming broader and less defined, or by new lines and bands appearing between them, till the spectrum at length loses all its characteristics and becomes identical with that of solid bodies when raised to the same temperature.

Hence the vibrating systems, which are the source of the emitted light, must be vibrating in a different manner in these two cases. When the spectrum consists of a number of bright lines, the motion of the system must be compounded of a corresponding number of types of harmonic vibration.

In order that a bright line may be sharply defined, the vibratory motion which produces it must be kept up in a perfectly regular manner for some hundreds or thousands of vibrations. If the motion of each of the vibrating bodies is kept up only during a small number of vibrations, then, however regular may be the vibrations of each body while it lasts, the resultant disturbance of the luminiferous medium, when analysed by the prism, will be found to contain, besides the part due to the regular vibrations, other motions, depending on the starting and stopping of each particular vibrating body, which will become manifest as a diffused luminosity scattered over the whole length of the spectrum. A spectrum of bright lines, therefore, indicates that the vibrating bodies when set in motion are allowed to vibrate in accordance with the conditions of their internal structure for some time before they are again interfered with by external forces.

It appears, therefore, from spectroscopic evidence that each molecule of a rarefied gas is, during the greater part of its existence, at such a distance from all other molecules that it executes its vibrations in an undisturbed and regular manner. This is the same conclusion to which we were led by considerations of another kind at p. 626.

We may therefore regard the bright lines in the spectrum of a gas as the result of the vibrations executed by the molecules while describing their free paths. When two molecules separate from one another after an encounter, each of them is in a state of vibration, arising from the unequal action on different parts of the same molecule during the encounter. Hence, though the centre of mass of the molecule describing its free path moves with uniform velocity, the parts of the molecule have a vibratory motion with respect to the

centre of mass of the whole molecule, and it is the disturbance of the luminiferous medium communicated to it by the vibrating molecules which constitutes the emitted light.

We may compare the vibrating molecule to a bell. When struck, the bell is set in motion. This motion is compounded of harmonic vibrations of many different periods, each of which acts on the air, producing notes of as many different pitches. As the bell communicates its motion to the air, these vibrations necessarily decay, some of them faster than others, so that the sound contains fewer and fewer notes, till at last it is reduced to the fundamental note of the bell. If we suppose that there are a great many bells precisely similar to each other, and that they are struck, first one and then another, in a perfectly irregular manner, yet so that, on an average, as many bells are struck in one second of time as in another, and also in such a way that, on an average, any one bell is not again struck till it has ceased to vibrate, then the audible result will appear a continuous sound, composed of the sound emitted by bells in all states of vibration, from the clang of the actual stroke to the final hum of the dying fundamental tone.

But now let the number of bells be reduced while the same number of strokes are given in a second. Each bell will now be struck before it has ceased to vibrate, so that in the resulting sound there will be less of the fundamental tone and more of the original clang, till at last, when the peal is reduced to one bell, on which innumerable hammers are continually plying their strokes all out of time, the sound will become a mere noise, in which no musical note can be distinguished.

In the case of a gas we have an immense number of molecules, each of which is set in vibration when it encounters another molecule, and continues to vibrate as it describes its free path. The molecule is a material system, the parts of which are connected in some definite way, and from the fact that the bright lines of the emitted light have always the same wave-lengths, we learn that the vibrations corresponding to these lines are always executed in the same periodic time, and therefore the force tending to restore any part of the molecule to its position of equilibrium in the molecule must be proportional to its displacement relative to that position.

From the mathematical theory of the motion of such a system, it appears that the whole motion may be analysed into the following parts, which may be considered each independently of the others:—In the first place, the centre of mass of the system moves with uniform velocity in a straight line. This velocity may have any value. In the second place, there may be a motion of rotation, the angular momentum of the system about its centre of mass remaining during the free path constant in magnitude and direction. This angular momentum may have any value whatever, and its axis may have any direction. In the third place, the remainder of the motion is made up of a number of component motions, each of which is an harmonic vibration of a given type. In each type of vibration the periodic time of vibration is determined by the nature of the system, and is invariable for the same system. The relative amount of motion in different parts of the system is also determinate for each type, but the absolute amount of motion and the phase of the vibration of each type are determined by the particular circumstances of the last encounter, and may vary in any manner from one encounter to another.

The values of the periodic times of the different types of vibration are given by the roots of a certain equation, the form of which depends on the nature of the connec-

tions of the system. In certain exceptionally simple cases, as, for instance, in that of a uniform string stretched between two fixed points, the roots of the equation are connected by simple arithmetical relations, and if the internal structure of a molecule had an analogous kind of simplicity, we might expect to find in the spectrum of the molecule a series of bright lines, whose wave-lengths are in simple arithmetical ratios.

But if we suppose the molecule to be constituted according to some different type, as, for instance, if it is an elastic sphere, or if it consists of a finite number of atoms kept in their places by attractive and repulsive forces, the roots of the equation will not be connected with each other by any simple relations, but each may be made to vary independently of the others by a suitable change of the connections of the system. Hence, we have no right to expect any definite numerical relations among the wave-lengths of the bright lines of a gas.

The bright lines of the spectrum of an incandescent gas are therefore due to the harmonic vibrations of the molecules of the gas during their free paths. The only effect of the motion of the centre of mass of the molecule is to alter the time of vibration of the light as received by a stationary observer. When the molecule is coming towards the observer, each successive impulse will have a shorter distance to travel before it reaches his eye, and therefore the impulses will appear to succeed each other more rapidly than if the molecule were at rest, and the contrary will be the case if the molecule is receding from the observer. The bright line corresponding to the vibration will therefore be shifted in the spectrum towards the blue end when the molecule is approaching, and towards the red end when it is receding from the observer. By observations of the displacement of certain lines in the spectrum, Dr. Huggins and others have measured the rate of approach or of recession of certain stars with respect to the earth, and Mr. Lockyer has determined the rate of motion of tornadoes in the sun. But Lord Rayleigh has pointed out that according to the dynamical theory of gases the molecules are moving hither and thither with so great velocity that, however narrow and sharply-defined any bright line due to a single molecule may be, the displacement of the line towards the blue by the approaching molecules, and towards the red by the receding molecules, will produce a certain amount of widening and blurring of the line in the spectrum, so that there is a limit to the sharpness of definition of the lines of a gas. The widening of the lines due to this cause will be in proportion to the velocity of agitation of the molecules. It will be greatest for the molecules of smallest mass, as those of hydrogen, and it will increase with the temperature. Hence the measurement of the breadth of the hydrogen lines, such as C or F in the spectrum of the solar prominences, may furnish evidence that the temperature of the sun cannot exceed a certain value.

We must now leave these speculations about the nature of molecules and contemplate the material universe as made up of molecules. Every molecule, so far as we know, belongs to one of a definite number of species. The list of chemical elements may be taken as representing the known species which have been examined in the laboratories. Several of these have been discovered by means of the spectroscope, and more may yet remain to be discovered in the same way. The spectroscope has also been applied to analyse the light of the sun, the brighter stars and some of the nebulae and comets, and has shown that the character of the light emitted by these bodies is similar in some cases to that emitted by terrestrial molecules, and in others to light from which the molecules have absorbed certain rays. In this way a considerable number of

coincidences have been traced between the systems of lines belonging to particular terrestrial substances and corresponding lines in the spectra of the heavenly bodies.

The value of the evidence furnished by such coincidences may be estimated by considering the degree of accuracy with which one such coincidence may be observed. The interval between the two lines which form Fraunhofer's line D is about the five hundredth part of the interval between B and G on Kirchhoff's scale. A discordance between the positions of two lines amounting to the tenth part of this interval, that is to say, the five thousandth part of the length of the bright part of the spectrum, would be very perceptible in a spectroscopic of moderate power.

If we adopt the theory of Boscovich, and assert that the primitive atom is a mere centre of force, having a certain definite mass, we may get over the difficulty about the equality of the mass of all atoms by laying it down as a doctrine which cannot be disproved by experiment, that mass is not a quantity capable of continuous increase or diminution, but that it is in its own nature discontinuous, like number, the atom being the unit, and all masses being multiples of that unit. We have no evidence that it is possible for the ratio of two masses to be an incommensurable quantity, for the incommensurable quantities in geometry are supposed to be traced out in a continuous medium. If matter is atomic, and therefore discontinuous, it is unfitted for the construction of perfect geometrical models, but in other respects it may fulfil its functions.

But even if we adopt a theory which makes the equality of the mass of different atoms a result depending on the nature of mass rather than on any quantitative adjustment, the correspondence of the periods of vibration of actual molecules is a fact of a different order.

We know that radiations exist having periods of vibration of every value between those corresponding to the limits of the visible spectrum, and probably far beyond these limits on both sides. The most powerful spectroscopic can detect no gap or discontinuity in the spectrum of the light emitted by incandescent line.

The period of vibration of a luminous particle is therefore a quantity which in itself is capable of assuming any one of a series of values, which, if not mathematically continuous, is such that consecutive observed values differ from each other by less than the ten thousandth part of either. There is, therefore, nothing in the nature of time itself to prevent the period of vibration of a molecule from assuming any one of many thousand different observable values. That which determines the period of any particular kind of vibration is the relation which subsists between the corresponding type of displacement and the force of restitution thereby called into play, a relation involving constants of space and time as well as of mass.

It is the equality of these space- and time-constants for all molecules of the same kind which we have next to consider. We have seen that the very different circumstances in which different molecules of the same kind have been placed have not, even in the course of many ages, produced any appreciable difference in the values of these constants. If, then, the various processes of nature to which these molecules have been subjected since the world began have not been able in all that time to produce any appreciable difference between the constants of one molecule and those of another, we are forced to conclude that it is not to the operation of any of these processes that the uniformity of the constants is due.

The formation of the molecule is therefore an event

not belonging to that order of nature under which we live. It is an operation of a kind which is not, so far as we are aware, going on on earth or in the sun or the stars, either now or since these bodies began to be formed. It must be referred to the epoch, not of the formation of the earth or of the solar system, but of the establishment of the existing order of nature, and till not only these worlds and systems, but the very order of nature itself is dissolved, we have no reason to expect the occurrence of any operation of a similar kind.

In the present state of science, therefore, we have strong reasons for believing that in a molecule, or if not in a molecule, in one of its component atoms, we have something which has existed either from eternity or at least from times anterior to the existing order of nature. But besides this atom, there are immense numbers of other atoms of the same kind, and the constants of each of these atoms are incapable of adjustment by any process now in action. Each is physically independent of all the others.

Whether or not the conception of a multitude of beings existing from all eternity is in itself self-contradictory, the conception becomes palpably absurd when we attribute a relation of quantitative equality to all these beings. We are then forced to look beyond them to some common cause or common origin to explain why this singular relation of equality exists, rather than any one of the infinite number of possible relations of inequality.

Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limit of our thinking faculties when we have admitted that, because matter cannot be eternal and self-existent, it must have been created. It is only when we contemplate not matter in itself, but the form in which it actually exists, that our minds find something on which it can lay hold.

The matter, as such, should have certain fundamental properties, that it should have a continuous existence in space and time, that all action should be between two portions of matter, and so on, are truths which may, for aught we know, be of the kind which metaphysicians call necessary. We may use our knowledge of such truths for purposes of deduction, but we have no data for speculating on their origin.

But the equality of the constants of the molecules is a fact of a very different order. It arises from a particular distribution of matter, a *collocation*, to use the expression of Dr. Chalmers, of things which we have no difficulty in imagining to have been arranged otherwise. But many of the ordinary instances of collocation are adjustments of constants, which are not only arbitrary in their own nature, but in which variations actually occur; and when it is pointed out that these adjustments are beneficial to living beings, and are therefore instances of benevolent design, it is replied that those variations which are not conducive to the growth and multiplication of living beings tend to their destruction, and to the removal thereby of the evidence of any adjustment not beneficial.

The constitution of an atom, however, is such as to render it, so far as we can judge, independent of all the dangers arising from the struggle for existence. Plausible reasons may, no doubt, be assigned for believing that if the constants had varied from atom to atom through any sensible range, the bodies formed by aggregates of such atoms would not have been so well fitted for the construction of the world as the bodies which actually exist. But as we have no experience of bodies formed of such variable atoms this must remain a bare conjecture.

Atoms have been compared by Sir J. Herschel to manufactured articles, on account of their uniformity. The uniformity of manufactured articles may be traced to very different motives on the part of the manufacturer. In certain cases it is found to be less expensive as regards trouble, as well as cost, to make a great many objects exactly alike than to adapt each to its special requirements. Thus, shoes for soldiers are made in large numbers without any designed adaptation to the feet of particular men. In another class of cases the uniformity is intentional, and is designed to make the manufactured article more valuable. Thus, Whitworth's bolts are made in a certain number of sizes, so that if one bolt is lost, another may be got at once, and accurately fitted to its place. The identity of the arrangement of the words in the different copies of a document or book is a matter of great practical importance, and it is more perfectly secured by the process of printing than by that of manuscript copying.

In a third class not a part only but the whole of the value of the object arises from its exact conformity to a given standard. Weights and measures belong to this class, and the existence of many well-adjusted material standards of weight and measure in any country furnishes evidence of the existence of a system of law regulating the transactions of the inhabitants, and enjoining in all professed measures a conformity to the national standard.

There are thus three kinds of usefulness in manufactured articles—cheapness, serviceableness, and quantitative accuracy. Which of these was present to the mind of Sir J. Herschel we cannot now positively affirm, but it was at least as likely to have been the last as the first, though it seems more probable that he meant to assert that a number of exactly similar things cannot be each of them eternal and self-existent, and must therefore have been made, and that he used the phrase "manufactured article" to suggest the idea of their being made in great numbers.

ATOOI, one of the larger Sandwich Islands, in the South Pacific Ocean. Towards the N.E. and N.W. the country is rugged and broken, but to the southward it is more level. The hills rise from the sea with a gentle acclivity, and, at a little distance back, are covered with wood; the central peaks attain an elevation of 7000 feet. The chief ports are Waimea and Hanalei. The island was one of the stations chosen for the observation of the transit of Venus in 1874. It is nearly 40 miles in length, and contains about 1,200 inhabitants.

ATRATO, a river of Colombia, South America, which, after a course of 250 miles, almost due N., for the most part through a low and swampy region, falls into the Gulf of Uraba or Darien. The gold and platinum mines of Choco were on some of its affluents, and its sands are still auriferous. The river has attracted considerable attention in connection with schemes for the construction of a ship-canal across the isthmus. It is navigable for small vessels for about 140 miles.

ATREK or ATTRUCK, a river which rises in the mountains of Khorasan, and flows W. along the borders of Persia and the Russian possessions, till it falls in the south-eastern corner of the Caspian, a short distance to the N. of Ashurada.

ATREUS, in *Greek Legend*, a son of Pelops, had, with his brother Thyestes, settled in Mycenæ, where he succeeded Eurystheus in the sovereignty, in which he was secured by the possession of a lamb or ram with a golden fleece. His wife Aërope, a daughter of Minos, bribed by Thyestes, assisted the latter to carry off the ram. But Zeus, in the interest of Atreus, wrought a miracle, causing the sun which before had risen in the west to rise to the east. Thyestes was driven from Mycenæ, but

returned to his brother begging to be forgiven. Atreus, appearing to welcome him, invited him to a banquet to eat of his own son, whom he had slain. From this crime followed the ills which befel Agamemnon, the son of Atreus.

ATRI or ATRIA, the ancient *Hadria*, a town of Naples, in the province of Abruzzo Ulteriore I., situated on a steep mountain 5 miles from the Adriatic, and 18 miles S.E. of Teramo. Remains of the ancient city have been discovered to the S. of the present site, consisting of the ruins of a theatre and baths, with pavements, and vases of Greek manufacture.

ATRIUM, the principal apartment in a Roman house, was entered through the *ostium* or *janua*, which opened off the *vestibulum*, a clear space between the middle of the house and the street, formed by the projection of the two sides. It was generally quadrangular in shape, and was roofed all over, with the exception of a square opening, called *compluvium*, towards which the roofs sloped, and by which the rain-water was conducted down to a basin (*impluvium*) fixed in the floor. In the early periods of Roman civilisation, the atrium was the common public apartment, and was used for the reception of visitors and clients, and for ordinary domestic purposes, as cooking and dining. In it were placed the ancestral pictures, the marriage-couch, the hearth, and generally a small altar. Here, too, were kept the looms at which the mistress of the house sat and span with her maid-servants. At a somewhat later period, and among the wealthy, separate apartments were built for kitchens and dining-rooms, and the atrium was kept as a general reception room for clients and visitors.

ATRIUM, in *Ecclesiastical Antiquities*, denotes an open place or court before a church. It consisted of a large area or square plat of ground, surrounded with a portico or cloister, situated between the porch or vestibule and the body of the church. In the centre was placed a fountain, wherein the worshippers washed their hands before entering church. In the atrium those who were not suffered to advance farther, and more particularly the first class of penitents, stood to solicit the prayers of the faithful as they went into the church. It was also used as a burying-ground, at first only for distinguished persons, but afterwards for all believers.

ATROPHY, a term in medicine used to describe a state of wasting due to some interference with the function of healthy nutrition. In the living organism there are ever at work changes involving the waste of its component tissues, which render necessary, in order to the preservation of life, the proper assimilation of nutritive material. It is also essential for the maintenance of health that a due relation exist between these processes of waste and repair, so that the one may not be in excess of the other. When the appropriation of nutriment exceeds the waste, hypertrophy or increase in bulk of the tissues takes place. (See HYPERTROPHY.) When, on the other hand, the supply of nutritive matter is suspended or diminished, or when the power of assimilation is impaired, atrophy or wasting is the result. Thus the whole body becomes atrophied in many diseases; and in old age every part of the frame, with the single exception of the heart, undergoes atrophic change. Atrophy may, however, affect single organs or parts of the body, irrespective of the general state of nutrition, and this may be brought about in a variety of ways. One of the most frequently observed of such instances is atrophy from disuse, or cessation of function. Thus, when a limb is deprived of the natural power of motion, either by paralysis or by painful joint disease, the condition of exercise essential to its nutrition being no longer fulfilled, atrophy of all its textures

sooner or later takes place. The brain in imbeciles is frequently observed to be shriveled, and in many cases of blindness there is atrophy of the optic nerve and optic tract. This form of atrophy is likewise well exemplified in the case of those organs and structures of the body which subserve important ends during foetal life, but which, ceasing to be necessary after birth, undergo a sort of natural atrophy, such as the thymus gland, and certain vessels specially concerned in the foetal circulation. The uterus after parturition undergoes a certain amount of atrophy, and the ovaries, after the child-bearing period, become shrunken. Atrophy of a part may also be caused by interruption to its normal blood supply, as in the case of the ligature or obstruction of an artery. Again, long standing disease, by affecting the nutrition of an organ and by inducing the deposit of morbid products, may result in atrophy, as frequently happens in affections of the liver and kidneys. Parts that are subjected to continuous pressure are liable to become atrophied, as is sometimes seen in internal organs which have been pressed upon by tumors or other morbid growths, and is well illustrated in the case of the feet of Chinese ladies, which are prevented from growing by persistent compression exercised from birth.

ATROPIA, or **ATROPINE**, $C_{17}H_{23}NO_3$, is an alkaloid existing in all parts of the deadly night-shade (*Atropa belladonna*). The seed of the thorn-apple (*Datura stramonium*) also contains an alkaloid, deturine, which long was believed to be identical with atropia. Recent researches seem to indicate that it is, however, only isomeric, and that it is only half as poisonous as atropia. A solution of sulphate of atropia in water dropped into the eye is now generally preferred for belladonna lotions or ointments for eye diseases.

ATROPOS, the eldest of the three Moirai, Parcae, or Fates. Her name, the Unalterable, indicates the part generally played by her, viz., that of rendering the decisions of her sisters irreversible or immutable.

ATTACHE (Fr.), one attached to or connected with another, as a part of his suite of attendants. The term is specifically applied to young diplomatists on the staff of an ambassador.

ATTACHMENT, in *Law*, is a process from a court of record, awarded by the court at its discretion, on a bare suggestion, or on its own knowledge, and is properly grantable in cases of contempt. It differs from arrest, in that he who arrests a man carries him to a person of higher power to be forthwith disposed of; but he that attaches keeps the party attached, and presents him in court at the day assigned, as appears by the words of the writ. Another difference is, that arrest is only upon the body of a man, whereas an attachment is often upon his goods. It is distinguished from distress in not extending to lands, as the latter does; nor does a distress touch the body as an attachment does. Every court of record has power to fine and imprison for contempt of its authority. Attachment being merely a process to bring the defendant before the court, is not necessary in cases of contempt in the presence of the court itself.

ATTACHMENT OF DEBTS.—It was suggested by the common law commissioners in 1853 that a remedy analogous to that of Foreign Attachment might be made available to creditors, after judgment, against debts due to their debtors. Accordingly, the Common Law Procedure Act, 1854, enacted that any creditor, having obtained judgment in the superior courts, should have an order that the judgment debtor might be examined as to any debts due and owing to him before a master of the court. On affidavit that the judgment was still unsatisfied, and that any other person within the

jurisdiction was indebted to the judgment debtor, the judge was empowered to attach all debts due from such third person to the judgment debtor.

In the *United States* attachment may be defined as the taking into the custody of the law the person or property of one who is already before the court, or of one whom it is sought to bring before the court; also a writ for this purpose. To some extent it is of the nature of a criminal process. In some States attachments are distinguished as foreign and domestic—the former issued against a non-resident having property within the jurisdiction of the State, the latter against a resident in the State, jurisdiction over the person or property being necessary for an attachment. An attachment issued under a State law which has not been adopted by Congress, or by a rule of court, cannot be sustained in a United States court. Money due to a seaman for wages is not attachable in the hands of a purser, the purser being a distributing agent for the government, and in no sense the debtor of the seaman.

ATTAINDER, in the *Law of England*, was the immediate and inseparable consequence from the common law upon the sentence of death. When it was clear beyond all dispute that the criminal was no longer fit to live, he was called *attaint*, *attinctus*, stained or blackened, and could not be a witness in any court. This attainder took place after judgment of death, or upon such circumstances as were equivalent to judgment of death, such as judgment of outlawry on a capital crime, pronounced for absconding from justice. Conviction without judgment was not followed by attainder. The consequences of attainder were Forfeitures. On attainder for treason, the criminal forfeited to the Crown his lands, rights of entry on lands, and any interest he might have in lands for his own life or a term of years. For murder, the offender forfeited to the Crown the profit of his freeholds during life, and in the case of lands held in fee-simple, the lands themselves for a year and a day; subject to this, the lands escheated to the lord of the fee. These forfeitures related back to the time of the offence committed. Forfeitures of goods and chattels ensued not only on attainder, but on conviction for a felony of any kind, or on flight from justice, and had no relation backwards to the time of the offence committed. Provision is made for the due administration of convicts' estates in the interests of themselves and their families. Forfeiture consequent on outlawry is exempted from the provisions of the Act.

ATTALIA, an ancient city of Pamphylia, named from Attalus II, king of Pergamus.

ATTAR, or **OTTO**, of **ROSES**, a well-known perfume of great strength, is an essential oil of roses, prepared chiefly in Hindustan and Persia. See **OILS** and **PERFUMERY**.

ATTENTION, in *Psychology* may be defined as the concentration of consciousness, or the direction of mental energy upon a definite object or objects.

ATTERBOM, **PETER DANIEL AMADEUS**, a Swedish poet, was born in Ostergöthland in 1790, studied in the University of Upsala from 1805 to 1815, became Professor of Philosophy there in 1828, and died in 1855. He was the leader in the great romantic movement which revolutionised Swedish literature.

ATTERBURY, **FRANCIS**, a man who holds a conspicuous place in the political, ecclesiastical, and literary history of England, was born in the year 1662, at Middleton in Buckinghamshire, a parish of which his father was rector. Francis was educated at Westminster School, and carried thence to Christ Church a stock of learning, which, though really scanty, he through life exhibited with such judicious ostentation that superficial observers believed his attainments to be immense. In

1687 he distinguished himself among many able men who wrote in defence of the Church of England, then persecuted by James II., and calumniated by apostates who had for lucre quitted her communion. Among these apostates none was more active or malignant than Obadiah Walker, who was master of University College, and who had set up there, under the royal patronage, a press for printing tracts against the established religion. In one of these tracts, written apparently by Walker himself, many aspersions were thrown on Martin Luther. Atterbury undertook to defend the great Saxon Reformer, and performed the task in a manner singularly characteristic. Whoever examines his reply to Walker will be struck by the contrast between the feebleness of those parts which are argumentative and defensive, and the vigor of those parts which are rhetorical and aggressive.

ATTICA, the most famous district of ancient Greece, is a triangular piece of ground projecting in a southeasterly direction into the Ægean Sea, the base line being formed by the continuous chain of Mounts Cithæron and Parnes, the apex by the promontory of Sunium. It is washed on two sides by the sea, and this feature seems to have given rise to the name. The coast is broken up into numerous small bights and harbors, which, however, are with few exceptions exposed to the south wind; the irregularity of the outline accounts for its great length in comparison of the superficial area of the country. The surface of Attica, as of the rest of Greece, is very mountainous, and between the mountain chains lie several plains of no great size, open on one side to the sea. On the west its natural boundary is the Corinthian Gulf, so that it would include the district of Megaris; and, as a matter of fact, before the Dorian invasion, which resulted in the foundation of Megara, the whole of this country was politically one, being in the hands of the Ionian race.

The central position of Attica in Greece was one main cause of its historical importance.

The mountains of Attica, which form its most characteristic feature, are to be regarded as a continuation of that chain which, starting from Mount Tymphrestus at the southern extremity of Pindus, passes through Phocis and Bœotia under the well-known names of Parnassus and Helicon; from this proceeds the range which, as Cithæron in its western and Parnes in its eastern portion, separates Attica from Bœotia, throwing off spurs southward towards the Saronic Gulf in Ægæleos and Hymettus, which bound the plain of Athens.

The soil is light and thin, and requires very careful agriculture to develop its produce. This feature belongs not only to the rocky mountain sides, but to some extent also to the maritime plains, and had considerable influence on the development of the inhabitants, both by enforcing industrious habits, and in leading them at an early period to take to the sea. Still, the level ground was sufficiently fertile to form a marked contrast to the rest of the district, and this fact is represented in the mythical genealogy of the early kings, which embodies several geographical features.

But whatever drawbacks the people of Attica experienced in respect of the soil were more than compensated by the fineness of the climate. In this point they enjoyed a great advantage over their neighbors the Bœotians; and while at the present day travellers speak of the excessive heat in summer and cold in winter which they have experienced in Bœotia, Attica has always been famous for its mildness.

When we turn to the vegetation of Attica, the olive first calls for our attention. This tree, we learn from Herodotus, was thought at one time to have been found

in that country only; and the enthusiastic praises of Sophocles teach us that it was the land in which it flourished best. So great was the esteem in which it was held, that in the early legend of the struggle between the gods of sea and land, Poseidon and Athena, for the patronage of the country, the sea-god is represented as having to retire vanquished before the giver of the olive; and at a later period the evidences of this contention were found in an ancient olive tree in the Acropolis, together with three holes in the rock, said to have been made by the trident of Poseidon, and to be connected with a salt well hard by. The fig also found its favorite home in this country, for Demeter was said to have bestowed it as a gift on the Eleusinian Phytalus, i.e., "the gardener."

Having thus noticed the general features of the country, let us proceed to examine it somewhat more in detail. It has been already mentioned that the base line is formed by the chain of Cithæron and Parnes, running from west to east; and that from this transverse chains run southward, dividing Attica into a succession of plains. The westernmost of these, which is separated from the innermost bay of the Corinthian Gulf, called the Mare Alcyonium, by an offshoot of Cithæron, and is bounded on the east by a ridge which ends towards the Saronic Gulf in a striking two-horned peak called Kerata, is the plain of Megara. It is only for geographical purposes that we include this district under Attica, for both the Dorian race of the inhabitants, and its dangerous proximity to Athens, caused it to be at perpetual feud with that city; but its position as an outpost for the Peloponnesians, together with the fact of its having once been Ionian soil, sufficiently explains the bitter hostility of the Athenians towards the Megarians. The great importance of Megara arose from its commanding all the passes into the Peloponnese. These were three in number: one along the shores of the Corinthian Gulf, which, owing to the nature of the ground, makes a long detour; the other two starting from Megara, and passing, the one by a lofty though gradual route over the ridge of Geraneia, the other along the Saronic Gulf, under the dangerous precipices of the Scironian rocks. The town of Megara, which was built on and between two low hills rising out of the plain rather more than a mile from the sea, had the command of both gulfs by means of its two ports—that of Pegæ on the Corinthian, and that of Nicæa on the Saronic.

To the east of the plain of Megara lies that of Eleusis, bounded on the one side by the chain of Kerata, and on the other by that of Ægæleos, through a depression in which was the line of the sacred way, where the torchlight processions from Athens used to descend to the coast, the "brightly-gleaming shores." Here a deep bay runs into the land, opposite to which, and separated from it by a strait, which forms a succession of graceful curves, was the rocky island of Salamis, at all times an important possession to the Athenians on account of its proximity to their city. The scene of the battle of Salamis was the narrowest part of this channel, where the island approaches the extremity of Ægæleos. The eastern portion of this plain was called the Thriasian plain, and the city of Eleusis was situated in the recesses of the bay. The coast-line of this part, between the sanctuary of Poseidon at the isthmus, which was originally Ionian, and Athens, is the principal scene of the achievements of Theseus, a hero who holds the same relation to the Ionians of Greece proper as Hercules does to the Greeks at large, viz., that of being the great author of improvements in the country.

Next in order to the plain of Eleusis came that of Athens, which is the most extensive of all, reaching from the foot of Parnes to the sea, and bounded on the

west by Ægaleos, and on the east by Hymettus. Its most conspicuous feature is the broad line of dark green along its western side, formed by the olive-groves of Colonus and the gardens of the Academus, which owe their fertility to the waters of the Cephissus, by which they are irrigated. This river is fed by copious sources on the side of Mount Parnes, and thus, unlike the other rivers of Attica, has a constant supply of water; but it does not reach the sea, nor did it apparently in classical times, having been diverted, then as now, into the neighboring plantations; for this is what Sophocles means when he speaks of "the sleepless fountains of Cephissus, which stray forth from their channels." The position of Colonus itself is marked by two bare knolls of light-colored earth, which caused the poet in the same chorus to apply the epithet "white" to that place. On the opposite side of the plain runs the other river, the Ilissus, which rises from a beautiful fountain in Mount Hymettus, and skirts the eastern extremity of the city of Athens; but this, notwithstanding its celebrity, is a mere brook which stands in pools a great part of the year, and in summer is completely dry. The situation of Athens relatively to the surrounding objects is singularly harmonious; for, while it forms a central point, so as to be the eye of the plain, and while the altar-rock of the Acropolis and the hills by which it is surrounded are conspicuous from every point of view, there is no such exactness in its position as to give formality, since it is nearer to the sea than to Parnes, and nearer to Hymettus than to Ægaleos. The most striking summit in the neighborhood of the city is that of Lycabettus, now Mount St. George, on the north-eastern side; and the variety is still further increased by the continuation of the ridge which it forms for some distance northwards through the plain. Three roads lead to Athens from the Boeotian frontier over the intervening mountain barrier—the easternmost over Parnes, from Delium and Oropus by Deceleia, which was the usual route of the invading Lacedæmonians during the Peloponnesian War; the westernmost over Cithæron, by the pass of Dryosephalæ, or the "Oak-heads," leading from Thebes by Platæa to Eleusis, and so to Athens, which we hear of in connection with the battle of Platæa, and with the escape of the Platæans at the time of the siege of that city in the Peloponnesian War; the third, midway between the two, by the pass of Phyle, near the summit of which, on a rugged height overlooking the Athenian plain, is the fort occupied by Thrasybulus in the days of the Thirty tyrants.

It still remains to mention the most famous spot of ground in Attica, the little plain of Marathon, which lays in the north-east corner, encircled on three sides by Parnes and Pentelicus, while the fourth faces the sea and the opposite coast of Eubœa. It was on the mountain slopes that the Greeks were stationed, while the Persians with their ships occupied the coast; and on the two sides the marshes may still be traced by which the movements of the invader's host were impeded. The mound, which at once attracts the eye in the centre of the level plain, is probably the burial-place of the Athenians who fell in the battle. The bay in front is sheltered by Eubœa, and is still more protected from the north by a projecting tongue of land, called Cynosura. The mountains in the neighborhood were the seat of one of the political parties in Attica, the Diacrii or Hyperacrii, who, being poor mountaineers, and having nothing to lose, were the principal advocates of change; while, on the other hand, the Pedæis, or inhabitants of the plains, being wealthy landholders, formed the strong conservative element and the Parali, or occupants of the sea-coast, representing the mercantile interest, held an intermediate position between the two.

Of the condition of Attica in mediæval and modern times little need be said, for it has followed for the most part the fortunes of Athens. The population, however, has undergone a great change, independently of the large admixture of Slavonic blood that has effected the Greeks of the mainland generally, by the immigration of Albanian colonists, who now occupy a great part of the country.

ATTICA, a city of New York, situated in the northern part of Wyoming county, is on the Erie and the New York Central railways, thirty-one miles east of Buffalo and forty-three miles southwest of Rochester. Among the industries are flour mills, carriage shops and tanneries.

ATTICUS, **TITUS POMPONIUS**, the friend of Cicero, was one of the most distinguished men during the period of the decline and fall of the Roman republic. His life gives an admirable picture of the classical man of culture, who, withdrawing from the stir of political affairs, devoted himself to literary and artistic pursuits. He was born at Rome 109 B.C., and was thus three years older than Cicero, along with whom he and the younger Marius were educated. He did not marry till he was 53 years of age, and his only child became the wife of Vipsanius Agrippa, the distinguished minister of Augustus. His large fortune was increased on the death of his uncle, L. Cæcilius, who bequeathed to him the greater part of his property. He formed a large library at Athens, and kept a staff of slaves engaged in making copies of valuable works. He probably derived considerable profits from the sale of these books. In 32 B.C., he was seized with an illness believed to be incurable. He resolved not to protract a painful and hopeless struggle, and died after five days of voluntary starvation.

ATTICUS HERODES, **TIBERIUS CLAUDIUS**, a very wealthy citizen of Athens, was born about 104 A.D. His grandfather's estates had been confiscated for treachery, but the fortunes of the family had been restored by the discovery in his father's house of an enormous sum of money, which the Emperor Nerva permitted them to retain. This great wealth Herodes afterwards increased by his marriage. He received a careful education under the most distinguished masters of the time, and specially devoted himself to the study of oratory, to excel in which seems to have been the ruling motive of his life. While very young he delivered a speech before one of the emperors; but it was so ill received that he was with difficulty restrained from throwing himself into the Danube. He ultimately attained to great celebrity as a speaker and as a teacher of rhetoric. Among his pupils were Marcus Aurelius and Lucius Verus. He was highly esteemed by the Antonines, particularly by Aurelius, and received many marks of favor, among others the archonship at Athens and the consulate at Rome. Atticus is principally celebrated, however, for the vast sums he expended on public purposes. He withdrew from Athens, and resided at his villa near Marathon, where he died about 180 A.D. None of his writings are extant.

ATTILA, or **ETZEL**, the famous leader of the Huns, surnamed the "Fear of the World," or the "Scourge of God," was born probably about 406 A.D. His father Mundzuk, king of the Huns, was succeeded by his brothers Octar and Rhuas; and on the death of Rhuas, in 434, Attila and his brother Bleda together ascended the throne. They ruled not only over the Huns, but over nearly all the tribes north of the Danube and the Black Sea; under their banners fought Ostrogoths, Gepide, Alani, Heruli, and many other Teutonic peoples. Their dominions are said to have extended from the Rhine to the frontiers of China. Attila was

superstitiously revered by his countrymen; he was said to possess the iron sword of the war-god, Mars, and he proclaimed himself to be the man-child born at Engaddi, who was destined to rule over the whole world. In 441 and 442 the brothers ravaged Thrace and Illyria, defeated the troops of the Eastern Empire in three great battles, and penetrated as far as Thermopylæ. Peace was made on the Romans agreeing to pay a heavy tribute. About this time Attila contrived to make away with his brother Bleda, and thus secured undivided supremacy. In 445 and the following years, he again directed his attacks against the Eastern Empire, and laid waste the whole country round Constantinople. Nowhere did he meet with resistance save from the brave little town of Azimus. The empire seemed about to succumb, when Theodosius entered into negotiations and made terms with his conqueror. While matters were being arranged, a plot was laid to assassinate Attila, in which the emperor was implicated. The conspiracy was discovered, and the barbarian upbraided the Christian monarch with his want of honor and manly courage. Theodosius died soon after, and his successor, Marcian, returned a firm refusal to Attila's demands for tribute. War seemed inevitable; but at this time the attention of the Hun was drawn to the Western Empire. It is said that the Princess Honoria, sister of Valentinian, tired of her life of enforced celibacy, sent her ring and an offer of her hand to Attila, who upon this grounded his claim to a part of the empire. It is probable, however, that he merely used this as a pretext, and that his real designs were more comprehensive. He evidently thought it a favorable opportunity for taking advantage of the enmity between the Romans and the Visigoths; and to this plan he was also induced by the proposals of Genseric, king of the Vandals, who offered to unite with him against his rival, Theodoric, king of the Visigoths. In 451 Attila assembled his forces, it is said 700,000 strong, led them through the centre of Germany, probably by Franconia, and crossed the Rhine, at what place cannot be determined. He defeated the Burgundians, and pushed on through the heart of Gaul, until his centre was checked by the valiant resistance offered by Orleans. Meanwhile, Theodoric and Aëtius, the Roman general, had collected and united their forces, and marching with all speed, arrived in time to raise the siege of Orleans. Attila retreated to a position in the plain of Chalons, and there concentrated his forces for a great engagement. A tremendous battle ensued—one of the most gigantic as well as most important contests recorded in history. The Romans, who formed one wing, were driven back, and although they kept together, and at nightfall retired to the camp of the Visigoths, Aëtius had given up the day as lost. The Visigoths, who were on the other wing, had also been repulsed, and were discouraged by the fall of their leader Theodoric. But the fortune of the day was changed by the impetuous bravery of Thorismund, Theodoric's son, who, burning to avenge his father's fall, led on the infuriated Visigoths, and drove Attila back to his camp. He even penetrated into the fortifications, but was wounded and thrown from his horse, and his followers with difficulty carried him off. Next day, Attila remained in camp in expectation of an attack, and having thrown all his baggage into a gigantic pile in the centre of the camp to be burned in case of defeat, resolved to sell his life dearly. But no attack was made; for Thorismund was persuaded by Aëtius to march to Toulouse in order to obtain his father's kingdom. Attila was thus enabled to retire in perfect security. Next year he poured his forces through the defiles of the Alps, and laid waste the whole north of Italy.

Rome itself seemed likely to fall before the invader when his course was arrested by an embassy headed by Pope Leo. Attila at once withdrew from Italy, but the motive which led him to act thus is not known. At the time his retreat was ascribed to the miraculous interposition of Providence, Peter and Paul having appeared in the camp of the Huns along with the embassy; the whole matter is, on the whole, rather obscure. Attila died in the year 453, from the bursting of a blood vessel, and his empire broke up immediately after his death.

ATTLEBOROUGH, a town of Bristol county, Mass., thirty-one miles southwest of Boston. It has good railroad connections, and contains national banks, newspaper offices, several churches, and a system of graded schools. The town is the seat of several important industries, the chief of which is the manufacture of jewelry and electro-plate. There are also manufactories of cotton, woolen and knit goods, and of boots and shoes. The township contains a large village known as North Attleborough, where similar industries are carried on. Attleborough had a population (1900) of 11,335.

ATTOCK, a town and fort of British India, in the Panjáb, situated on the eastern bank of the Indus. The place is both of political and commercial importance.

ATTORNEY, in *English Law*, signifies, in its widest sense, any substitute or agent appointed to act in "the turn, stead, or place of another." The term is now commonly confined to a class of qualified agents who undertake the conduct of legal proceedings for their clients. By the common law the actual presence of the parties to a suit was considered indispensable, but the privilege of appearing by attorney was conceded in certain cases by special dispensation, until the statute of Merton and subsequent enactments made it competent for both parties in all judicial proceedings to appear by attorney. Solicitors appear to have been at first distinguished from attorneys, as not having the attorney's power to bind their principals, but latterly the distinction has been between attorneys as the agents formally appointed in actions at law, and solicitors who take care of proceedings in Parliament, Chancery, Privy Council, &c. In practice, however, and in ordinary language, the terms are synonymous.

In the United States, legal counsel, of whatever nature, whether in criminal or civil procedure, is styled an attorney—comprehending at once the functions of the English solicitor, attorney, counsel and barrister—no distinction being made, the practising *lawyer* combining in his person all legal attributes of these professions.

ATTORNEY-GENERAL, the chief law officer appointed to manage all the legal affairs and suits in which the government is interested.

ATTRACTION. That the different parts of a material system influence each other's motions is a matter of daily observation. In some cases we cannot discover any material connection extending from the one body to the other. We call these cases of action at a distance, to distinguish them from those in which we can trace a continuous material bond of union between the bodies. The mutual action between two bodies is called stress. When the mutual action tends to bring the bodies nearer, or to prevent them from separating, it is called tension or attraction. When it tends to separate the bodies, or to prevent them from approaching, it is called pressure or repulsion. The names tension and pressure are used when the action is seen to take place through a medium. Attraction and repulsion are reserved for cases of action at a distance. The configuration of a material system can always be defined in terms of the mutual distances of the parts of the system. Any change of configuration

must alter one or more of these distances. Hence the force which produces or resists such a change may be resolved into attractions or repulsions between those parts of the system whose distance is altered.

There has been a great deal of speculation as to the cause of such forces, one of them, namely, the pressure between bodies in contact, being supposed to be more easily conceived than any other kind of stress. Many attempts have therefore been made to resolve cases of apparent attraction and repulsion at a distance into cases of pressure. At one time the possibility of attraction at a distance was supposed to be refuted by asserting that a body cannot act where it is not, and that therefore all action between different portions of matter must be by direct contact. To this it was replied that we have no evidence that real contact ever takes place between two bodies, and that, in fact, when bodies are pressed against each other and in apparent contact, we may sometimes actually measure the distance between them, as when one piece of glass is laid on another, in which case a considerable pressure must be applied to bring the surfaces near enough to show the black spot of Newton's rings, which indicates a distance of about a ten thousandth of a millimetre. If, in order to get rid of the idea of action at a distance, we imagine a material medium through which the action is transmitted, all that we have done is to substitute for a single action at a great distance a series of actions at smaller distances between the parts of the medium, so that we cannot even thus get rid of action at a distance.

The study of the mutual action between the parts of a material system has, in modern times, been greatly simplified by the introduction of the idea of the energy of the system. The energy of the system is measured by the amount of work which it can do in overcoming external resistances. It depends on the present configuration and motion of the system, and not on the manner in which the system has acquired that configuration and motion. A complete knowledge of the manner in which the energy of the system depends on its configuration and motion, is sufficient to determine all the forces acting between the parts of the system. For instance, if the system consists of two bodies, and if the energy depends on the distance between them, then if the energy increases when the distance increases, there must be attraction between the bodies, and if the energy diminishes when the distance increases, there must be repulsion between them.

Newton in his *Principia*, deduces from the observed motions of the heavenly bodies the fact that they attract one another according to a definite law. This he gives as a result of strict dynamical reasoning, and by it he shows how not only the more conspicuous phenomena, but all the apparent irregularities of the celestial motions are the calculable results of a single principle. In his *Principia* he confines himself to the demonstration and development of this great step in the science of the mutual action of bodies. He says nothing there about the means by which bodies gravitate towards each other. But his mind did not rest at this point. We know that he did not believe in the direct action of bodies at a distance. And we also know that he sought for the mechanism of gravitation in the properties of an æthereal medium diffused over the universe.

In his *Optical Queries*, indeed, he shows that if the pressure of this medium is less in the neighborhood of dense bodies than at great distances from them, dense bodies will be drawn towards each other, and that if the diminution of pressure is inversely as the distance from the dense body the law will be that of gravitation. The next step, as he points out, is to account for this inequality of pressure in the medium; and as he was not

able to do this, he left the explanation of the cause of gravity as a problem to succeeding ages. As regards gravitation the progress made towards the solution of the problem since the time of Newton has been almost imperceptible. Faraday showed that the transmission of electric and magnetic forces is accompanied by phenomena occurring in every part of the intervening medium. He traced the lines of force through the medium; and he ascribed to them a tendency to shorten themselves and to separate from their neighbors, thus introducing the idea of stress in the medium in a different form from that suggested by Newton; for, whereas Newton's stress was a hydrostatic pressure in every direction, Faraday's is a tension along the lines of force, combined with a pressure in all normal directions. By showing that the plane of polarisation of a ray of light passing through a transparent medium in the direction of the magnetic force is made to rotate, Faraday not only demonstrated the action of magnetism on light, but by using light to reveal the state of magnetisation of the medium, he "illuminated," to use his own phrase, "the lines of magnetic force."

From this phenomenon Thomson afterwards proved, by strict dynamical reasoning, that the transmission of magnetic force is associated with a rotatory motion of the small parts of the medium. He showed, at the same time, how the centrifugal force due to this motion would account for magnetic attraction.

It is remarkable that of the three hypotheses, which go some way towards a physical explanation of gravitation, every one involves a constant expenditure of work. That of the generation or absorption of fluid requires, not only constant expenditure of work in emitting fluid under pressure, but actual creation and destruction of matter. That of waves requires some agent in a remote part of the universe capable of generating the waves.

According to such hypotheses we must regard the processes of nature not as illustrations of the great principle of the conservation of energy, but as instances in which, by a nice adjustment of powerful agencies not subject to this principle, an apparent conservation of energy is maintained. Hence we are forced to conclude that the explanation of the cause of gravitation is not to be found in any of these hypotheses.

ATTWOOD, THOMAS, musical composer, was born in London in 1767, and died in 1838.

ATWOOD, GEORGE, an author celebrated for the accuracy of his mathematical and mechanical investigations, and considered particularly happy in the clearness of his explanations, and the elegance of his experimental illustrations, was born in the early part of the year 1746, and died in 1807.

ATYS, ATTIS, or ATTES, in the *Phrygian and Lydian Mythology*, a youth beloved for his beauty by the goddess Rhea, there called Agdistis. Like Adonis, he was the personification of the changes in nature, from the beauty of spring and summer to the severity and darkness of winter. The story, as told at Pessinus, the centre of the worship of the goddess, was that she had borne to Zeus a being both male and female; that the gods displeased, had transformed this being into a tree, from the fruit of which the daughter of the river-god Sangarius bore a boy, who grew up among herdsmen marvellous in his beauty so as to win the love of Agdistis. This was Atys, and he was about to be married to the king's daughter of Pessinus, when the goddess appeared among the guests, terrified them, and caused Atys to run to the woods, where he maimed himself and was transformed into a pine tree; from his blood sprang violets.

AUBAGNE, a town of France in the department of Bouches-du-Rhône, with a population of 7408, who

carry on the manufacture of wine, pottery, leather, coarse cloth, &c.

AUBE, a department of France bounded on the N. by the department of Marne, N. W. by Seine-et-Marne, W. by Yonne, S. by Cote-d'Or, and E. by Haute-Marne. It consists of a portion of Champagne and Vallage, with a small part of Burgundy, and has an area of 2317 square miles. Its general inclination from S. E. to N. W. presents little variety of surface, the only elevations being a double line of hills along the course of the Seine, never exceeding 1150 feet in height. The department belongs to the Seine basin, and is watered by that river and its tributaries, the Ource, the Sarce, the Melda, and the Aube, &c. The climate is comparatively mild, but damp. Among the celebrated men connected with Aube are Villehardouin, Pope Urban IV., Mignard, Danton, Beugnot, and Ulbach. The capital is Troyes, and the arrondissements are Troyes, Arcis-sur-Aube, Nogent-sur-Seine, Bar-sur-Aube, and Bar-sur-Seine. Population in 1901, 245,596.

AUBENAS, a town of France, department of Ardèche, near the river of that name, 14 miles S. W. of Privas. It is beautifully situated on the slope of a hill, but its streets generally are crooked and narrow. Population 7694.

AUBER, DANIEL FRANÇOIS ESPRIT, musical composer, the chief representative of the French school, was the son of a Paris printerseller. He was born at Caen, in Normandy, on the 29th January 1782, while his mother was on a visit to that town. Destined by his father to the pursuits of trade, he was allowed, nevertheless, to indulge his fondness for music, and learnt to play at an early age on several instruments, his first teacher being the Tyrolean composer, Ladurner. Sent at the age of twenty to London to complete his business training, he returned after the rupture of the peace of Amiens. He had already attempted musical composition, and at this period produced several *concertos pour basse*; in the manner of the violoncellist, Lamare, in whose name they were published. The praise given to his concerto for the violin, which was played at the Conservatoire by Mazas, encouraged him to undertake the resetting of the old comic opera, *Julie*. Conscious by this time of the need of regular study of his chosen art, he placed himself under the severe training of Cherubini, by which the special qualities of the young composer were admirably developed. In 1813 he made his *début* in an opera in one act, the *Séjour Militaire*, the unfavorable reception of which put an end for some years to his attempts as composer. But the failure in business and death of his father, in 1819, compelled him once more to turn to music, and to make that which had been his pastime the serious employment of his life. He produced another opera, the *Testament et les Billets-doux*, which was no better received than the former. But he persevered, and the next year was rewarded by the complete success of his *Bergère Châtelaine*, an opera in three acts. This was the first in a long series of brilliant successes, terminating only in the eighty-sixth year of his age. In 1822 began his long association with M. Scribe, who shared with him as librettist the success and growing popularity of his compositions. The opera *Leicester*, in which they first worked together (1823), is remarkable also as showing the first evidences of the influence of Rossini on Auber's style. This style was, however, distinctly original, and was easily recognisable. A phrase of Auber, said his friend Théodore Gautier, is not the phrase of any one else. His characteristics are lightness and facility, sparkling vivacity, grace and elegance, clear and piquant melodiousness,—these marking him out as a true son of France, and making him her darling singer.

Depth of thought, elevation of sentiment, intensity of passion, inspiration which grasps the sublime and the infinite,—these are not in Auber.

Devoted by preference to the comic opera, as the most fitting field for his talents, he ventured on more than one occasion to pass into the field of grand opera, and in his *La Muette de Portici*, familiarly known as *Masaniello*, he achieved his greatest musical triumph. Produced at Paris in 1828, it rapidly became a European favorite, and its overture, songs, and choruses were everywhere heard. The duet, *Amour sacré de la patrie* was welcomed like a new *Marseillaise*; sung by Nourrit at Brussels in 1830, it became the signal for the revolution which broke out there. Among his other works, about fifty in all, the more important are—*Fra Diavolo* (1830), *Lestocq* (1834), *L'Ambassadrice* (1836), *Le Domino Noir* (1837), *Le Lac des Fées* (1839), *Les Diamants de la Couronne* (1841), *Haydée* (1847), *Marco Spada* (1853), and *La Fiancée du roi de Garbe* (1864). Official and other dignitaries testified the public appreciation of Auber's works. In 1829 he was elected member of the Institute, in 1830 he was named director of the court concerts, and in 1842 he succeeded Cherubini as director of the Conservatoire. He was also a member of the Legion of Honor from 1825, and attained the rank of commander in 1847. One of Auber's latest compositions was a march, written for the opening of the International Exhibition in London in 1862. His fascinating manners, his witty sayings, and his ever ready kindness and beneficence won for him a secure place in the respect and love of his fellow-citizens. He remained in his old home during the German siege of Paris, 1870-71, but the miseries of the Communist war which followed sickened his heart, and he at last refused to touch his beloved instrument, or to take food. He died May 13, 1871.

AUBIN, a town of France, in the department of Aveyron and arrondissement of Villefranche, principally remarkable for its extensive mines of coal, sulphur, and alum. It also carries on an active trade in sheep, iron goods, &c.

The name Aubin, or St. Aubin, is one of the most frequent in France, being borne by upwards of fifty villages from the Pyrenées to Jersey.

AUBURN, the capital of Cayuga county, in the state of New York, on the railway, between Albany and Buffalo, 174 miles W. of the former. The irregularity of the surface on which the city is built has prevented the complete carrying out of the rectangular arrangement of streets, which is so much in favor in the United States, but the thoroughfares are wide and lined with trees, and the houses for the most part well built. The principal public buildings are in Genesee Street. The most remarkable of the institutions is the state prison, founded in 1816, which is conducted on the "silent system," and usually contains upwards of 1000 prisoners, who are employed each in the work to which he has been trained. Population (1900), 30,345.

AUBURN, the county seat of Androscoggin county, Me. It is a place of some importance as a commercial centre. Pop. (1900), 12,951.

AUBUSSON, a town of France, situated in a picturesque valley on the banks of the Creuse, in the department to which that river gives its name. Pop. 3,000.

AUCH, the ancient *Climberrum* or *Augusta Auscorum*, one of the most ancient cities of France, capital of the department of Gers. In Caesar's time this was the chief town of the Ausci. In the 8th century it became the capital of Gascony, and when that district was divided into countships, was the capital of Armagnac.

AUCHTERARDER, a town and parish of Scotland, county of Perth, 15 miles W. S. W. of Perth.

AUCHTERMUCHTY, a royal burgh and parish of Scotland, county of Fife, 8 miles W.S.W. of Cupar.

The town is irregularly built on an elevated site, and is divided by the Leverspool, a rapid streamlet which runs down its center. The manufacture of linen is carried on. The population of the burgh in 1901 was about 2,000.

AUCKLAND, the northern provincial district of New Zealand, includes fully a half of North Island, and is about 400 miles long by 200 wide at its greatest breadth. The bays of its coast-line afford safe harborage, and its rivers serve as highways for the produce of the interior. There are three almost natural divisions of this district: North Peninsula, East Coast and the Waikato Country—the latter two, which had been mainly in the hands of the natives, have lately been opened up for European settlements. The land is chiefly of two kinds—a light volcanic loam, and a stiff yellow clay. For the most part it is broken, with low ranges of hills and broad shallow valleys covered to a great extent with dense forests. It is less suited for grazing than for agricultural purposes. Gold, copper, tin, iron, coal, and other minerals exist in Auckland, which is also very rich in timber, the most important tree being the Kauri pine. The fossil gum of ancient forests of this pine is dug up in large quantities, and exported. Much New Zealand flax is grown and manufactured. About 200 miles of railway give connection with the agricultural districts. The annual value of the exports, including wool, Kauri gum, timber, flax, and gold, average \$5,000,000; the imports are double that amount. The value of the gold exported from 1857 to 1890 was over \$33,000,000. The climate is pleasant and healthy, and owing to sea-breezes, the summer heat is not so great as in other parts of Australasia in the same latitude. Ferns grow in perfection, upwards of 130 species being found. Volcanic action has deeply left its mark on the surface of Auckland; there is still an active volcano near the city of Auckland; and the warm lake and geyser scenery of the region, about ninety miles Southeast from Auckland, below the Bay of Plenty, is considered by travelers the most remarkable in the world. The "Hot Lake" district covers an area about 120 miles long, by ten to fifteen miles wide, and includes hot springs, cisterns of hot water, and mud volcanoes. A sanatorium for bathing purposes exists near Lake Taupo and at Ohinenutu on Rotoma. The other lakes are Tarawera, Rotoiti and Rotomahana. The wonderful pink and white terraces near Tarawera Lake were destroyed by a volcanic eruption in 1886. The white terrace, which had the appearance of a crystal staircase, glittering and stainless, as of ice, was produced by deposits of silica from the boiling springs; the pink terrace, its companion, was flushed with a pale rose color, believed to have been caused by the presence of oxide of iron. Auckland was the scene of the labors of Bishops Selwyn and Patteson. The population in 1875 was 79,104; 1881, 99,451; 1901, 175,938.

For a descriptive account of a large part of the province, the reader is referred to Dr. Hochstetter's valuable works, especially to his *New Zealand*, 1863. A very graphic sketch of some of the natural curiosities is furnished by Anthony Trollope in his *Australia and New Zealand*, vol. ii.

AUCKLAND, the capital of the above province, is finely situated on an isthmus in the N.W. peninsula, on the S. shore of the Waitemata harbor, which is formed by an inlet of the Hauraki Gulf. Lat. 36° 51' S., long. 174° 50'. On the other side of the isthmus lies the harbor and town of Manukau, which serves as a supplementary port to the city. Auckland was founded in 1840 by Governor Hobson, and became a burgh in

1851. It was till 1865 the seat of government, which is now situated at Wellington. The city has a fine appearance, especially from the harbor, and is surrounded by a number of flourishing suburban villages, with several of which it is connected by railway. Pop. 67,226.

AUCKLAND ISLANDS, a group discovered in 1806 by Captain Briscoe, of the English whaler "Ocean," about 180 miles S. of New Zealand. The islands, of volcanic origin, are very fertile, and are covered with forest.

AUCKLAND, WILLIAM EDEN, BARON, an eminent diplomatist and politician, third son of Sir Robert Eden, Bart., of West Auckland, was born in 1744. He was educated at Eton and Oxford, and adopted the profession of the law. At the age of twenty-seven he resigned his practice at the bar, and engaged in political life as under-secretary to Lord Suffolk. By the favor of the duke of Marlborough, he obtained a seat for Woodstock, and soon gave proof of his ability in the House. He attached himself to Lord North's party, and after serving under Lord Carlisle on the unsuccessful commission to the colonists in America, acted as secretary to that nobleman, when he held the post of viceroy in Ireland. During this time he had obtained the offices of director and auditor of Greenwich Hospital, which probably yielded him an income sufficient for carrying on his political career. In 1783 he took a leading part in negotiating the remarkable coalition between North and Fox, and was rewarded by being made vice-treasurer of Ireland. In 1784 he opposed Pitt's proposal for commercial reciprocity with Ireland, but in so doing contrived to separate himself to some extent from his own party, and shortly after accepted from Pitt the office of plenipotentiary at Paris. Here he successfully negotiated the important commercial treaty with France; and after his appointment as ambassador to Spain, he rendered valuable service in settling the dispute between the British and French Governments with regard to the affairs of Holland. In 1789 he was made an Irish peer, with the title of Baron Auckland, and in 1793 he was raised to the British peerage as Baron Auckland, of West Auckland, Durham.

AUCKLAND, GEORGE EDEN, EARL OF, Governor-General of India, born 20th August, 1784, was the second son of the foregoing. He died January 1, 1849.

AUCTION, a mode of selling property by offering it to the highest bidder in a public competition. It is the duty of an auctioneer to sell for the best price he can obtain, and his authority cannot be delegated to another unless by special permission of his employer. The auctioneer's name must be exhibited on some conspicuous place during the sale. Sales by auction usually take place under certain conditions, which it is the duty of the auctioneer to read to the bidders before the sale begins. To complete a sale by auction there must be a *bidding* by, or on behalf of, a person capable of making a contract, and an *acceptance* thereof by the auctioneer, and until the bidding is accepted both vendor and bidder are free, and may retract if they choose.

AUDÆUS, or AUDIUS, a reformer of the 4th century, by birth a Mesopotamian. He suffered much persecution from the Syrian clergy for his fearless censure of their irregular lives, and was expelled from the church. He was afterwards banished into Scythia, where he gained many followers and established the monastic system. He died there at an advanced age, about 370 A. D.

AUDE, a southern department of France, forming part of the old province of Languedoc, bounded on the E. by the Mediterranean, N. by the departments of Hérault and Tarn, N.W. by Upper Garonne, W. by

Ariège and south by that of the Eastern Pyrenees. Area, 2,438 square miles. Pop. (1901), 311,386.

AUDEBERT, JEAN BAPTISTE, a distinguished French naturalist and artiste, was born at Rochefort in 1759 and died 1800.

AUDITOR, a person appointed to examine the accounts kept by the financial officers of the government, public corporations, or private persons, and to certify as to their accuracy.

AUDOUIN, JEAN VICTOR, a distinguished French entomologist, was born at Paris, April 27, 1797. He began the study of law, but was diverted from it by his strong predilection for natural history. He became eminent as an anatomist and died 1841.

AUDRAN, the name of a family of French artists and engravers, who for several generations were distinguished in the same line. The first who devoted himself to the art of engraving was Claude Audran, born 1592, and the last was Benoit, Claud's great-grandson, who died in 1712. The two most distinguished members of the family were Gerard, or Girard Audran, born 1640, and Jean Audran, born 1657, and died in 1767.

AUDUBON, JOHN JAMES, a well-known naturalist, was born in 1781, in Louisiana, where his parents, who were French Protestants, had taken up their residence while it was still a Spanish colony. They afterwards settled in Pennsylvania. From his early years he had a passion for observing the habits and appearances of birds, and attempting delineations of them from nature. At the age of fifteen he was sent to Paris, and remained there about two years, when, among other studies, he took some lessons in the drawing-school of David. On returning to America his father established him in a plantation in Pennsylvania, and he soon after married. But nothing could damp his ardor for natural history. For fifteen years he annually explored the depths of the primeval forests of America in long and hazardous expeditions, far from his family and his home. In these excursions he acquired the facility of making those spirited drawings of birds that give such value to his magnificent work, *The Birds of America*. At that period he had not dreamed of any publication of his labors; as he informs us, "it was not the desire of fame that prompted to those long exiles; it was simply the enjoyment of nature." He afterwards removed with his family to the village of Henderson on the banks of the Ohio, where he continued his researches in natural history for several years, and at length set out for Philadelphia with a portfolio containing 200 sheets filled with colored delineations of about 1,000 birds. Business obliged him to quit Philadelphia unexpectedly for some weeks, and he deposited his portfolio in the warehouse of a friend; but to his intense dismay and mortification, he found, on his return, that these precious fruits of his wanderings and his labors had been totally destroyed by rats. The shock threw him into a fever of several weeks' duration, that well-nigh proved fatal. But his native energy returned with returning health; and he resumed his gun and his game-bag, his pencils and his drawing-book, and plunged again into the recesses of the backwoods. In about three years he had again filled his portfolio, and then rejoined his family, who had in the meantime gone to Louisiana. After a short sojourn there he set out for the Old World, to exhibit to the ornithologists of Europe the riches of America in that department of natural history.

In 1826 Audubon arrived at Liverpool, where the merits of his spirited delineations of American birds were immediately recognized. An exhibition of them to the public in the galleries of the Royal Institution of

that town was so successful that it was repeated at Manchester and at Edinburgh, where they were no less admired. When he proposed to publish a work on the birds of America, several naturalists advised him to issue the work in large quarto, as the most useful size for the lovers of natural history, and the most likely to afford him a sufficient number of subscribers to remunerate his labors. At first he yielded to this advice, and acknowledged its soundness; but finally he decided that his work should eclipse every other ornithological publication. Every bird was to be delineated of the size of life, and to each species a whole page was to be devoted; consequently the largest *elephant folio* paper was to receive the impressions. This necessarily increased the expense of the work so much as to put it beyond the reach of most scientific naturalists— which accounts for the small number of persons who for a considerable time, could be reckoned among his supporters in the gigantic undertaking. The exceptionally high character of the work, however, gradually became known; and a sufficient number of subscribers was at length obtained in Great Britain and America, during the ten or twelve years that the work was going through the press, to indemnify him for the great cost of the publication—leaving him, however, a very inadequate compensation for his extraordinary industry and skill. The first volume was published at New York in the end of the year 1830, the second in 1834, the third in 1837, and the fourth and last in 1839. The whole consists of 445 colored plates containing 1,055 figures of birds the size of life. It is certainly the most magnificent work of the kind ever given to the world, and is well characterized by Cuvier, "C'est le plus magnifique monument que l'Art ait encore élevé à la Nature."

During the preparation and publication of his great work Audubon made several excursions from Great Britain. In the summer of 1828 he visited Paris, where he made the acquaintance of Cuvier, Humboldt, and other celebrated naturalists, and received from them every mark of honor and esteem. The following winter he passed in London. In April of 1830 he revisited the United States of America, and again explored the forests of the central and southern federal territories. In the following year he returned to London and Edinburgh, but the August of 1831 found him again in New York. The succeeding winter and spring he spent in Florida and South Carolina; and in the summer of 1832 he set out for the Northern States, with an intention of studying the annual migrations of birds, particularly of the passenger pigeon, of which he has given a striking description; but his career was arrested at Boston by a severe attack of cholera, which detained him there till the middle of August. After that he explored the coasts, lakes, rivers and mountains of North America, from Labrador and Canada to Florida, during a series of laborious journeys, that occupied him for three years. From Charleston, accompanied by his wife and family, he took his third departure for Britain. During his earlier residence in Edinburgh he had begun to publish his *American Ornithological Biography*, which at length filled five large octavo volumes. The first was issued by Adam Black in 1831; the last appeared in 1839. This book is admirable for the vivid pictures it presents of the habits of the birds, and the adventures of the naturalist. The descriptions are characteristically accurate and interesting. In 1839 Audubon returned to America, and shortly afterward commenced the publication of his two last works, *The Quadrupeds of America* and a *Biography of American Quadrupeds*. The latter was issued in 1850. On January 27, 1851, Audubon died at New York.





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